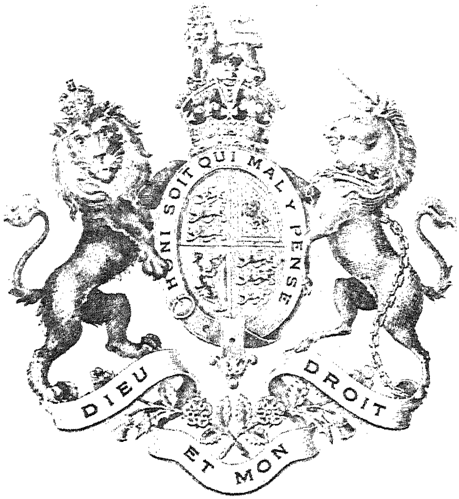
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AGRICULTURAL RESEARCH INSTITUTE

PUSA

The Journal
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

ISSUED QUARTERLY.

VOLUME XVIII.

JANUARY, 1925—OCTOBER, 1925.

EDITED BY:

C. L. C. BOURNE.

AND

L. S. DAVIS.

British Guiana.

PRINTED BY "THE DAILY CHRONICLE," LTD., GEORGETOWN.

1926.

INDEX TO VOL. XVIII.

1925.

A. Page.

Agricultural and Forest Products, Exports of— 67,134,234,310
Agricultural Census Returns 107
Agricultural Conditions, Co-operative Marketing as a Factor in Improving— 299
Agriculture, The Role of Plant Physiology in— 113
A Guide for Beginners in Chicken Raising 184
Agyrtria chionopectus 100
Agyrtria leucogaster 100
Agyrtria tobaci 100
A New Use for Cacao 183
Aphis maidis 219,229,221,222
Ardea candidissima 106
Ardea cyanura 105
Ardea egretta 106
Arsenated Petroleum as a Wood Preservative ... 70
Arundinicola leucocephala 50
Asturina magnirostris 104
Attendances at the District Gardens 64,132,233,309

B.

Bacon, Home Curing of— 286
Bacterium malvacearum 283
Birds as Friends 155
Birds of Georgetown, Native— ... 30,93
Board of Agriculture, Meetings of the— 20,135,240
Botanical Problems, Cacao— 293
Brassolis sophorae 18

B.—(Contd.)

Page

British Guiana at Wembley ... 235,292
Bursera gummifera 3
Busraellus nigricollis 104
Buteogallus aequinoctialis 103

C.

Cacao, A new use for— 183
Cacao, Some Botanical Problems— ... 293
Cajanus indicus 121, 170
Campylopterus largipennis 98
Cane after cutting, Deterioration of— ... 157
Carthartes atrata 103
Carthartes aura 103
Carthartes pernigra 103
Carthartes urubitinga 103
Cassicus persicus 45
Census returns, Agricultural— 107
Certhiola chloropyga 37
Ceryle superciliosa 96
Ceryle torquata 96
Chaetura spinicauda 101
Chamaepelia griseola 105
Chamaepelia passerina 105
Charadrius virginicus 106
Charcoal, The value of— 83
Chicken Raising, A Guide for Beginners in— ... 184
Chlorops taeniophus 55
Chrysobronchus virescens 100
Chrysolampis moschitus 99
Chrysotis ochrocephala 106
Ciconia maguari 106
Coccygus americanus 96
Coccygus minor 96
Columbia rufina 106
Co-operative Marketing as a Factor in Improving Agricultural Conditions } 299
Cotton in Trinidad 77

C.—(Contd.)

Page.

Cotton Research Station 274
County of Essequibo Agricultural, Industrial and Live Stock Exhibition } 71
Crop Production in India, Drainage and— ... 84
Crop Production, Present day Problems in— ... 51
Crotalaria striata 170
Crotophaga ani 95
Crotophaga major 95
Cultivation, Sugar Cane— 262
Cyperus rotuudus 17

D

Dacnis cayana 38
Dendroeca aestiva 38
Deterioration of Cane after Cutting 157
Development of Manless Ploughs 128
Diplopterus maevius 95
Disease of Cane, Soil Hygiene in its Relation to— 256
District Gardens, Attendances at the— 64,132,233,309
Donacobius atricapillus 34
Drainage and Crop Production in India ... 84

E

Echinochloa colonum 217,223
Editorial Notes 1,69,237
Elainea albiceps 49
Elainea pagana 49
Eleusine indica 217,223
Engyptila rufaxilla 106
Erythrina coralladendron 15
Erythrina edulis 12
Eucephala caerulea 100
Eudocimus ruber 106
Euphonia plumbea 41

E.—(Contd.)

Page.

Euphonia violacea 41
Exhibition, County of Essequibo Agricultural Industrial & Live Stock— 71
Exports of Agricultural and Forest Products 67,134, 234,310

F.

Farmers, Practical Hints to— 226
Fertilisers from Soils, The Leaching of— ... 171
Fluvicola pica 49

G.

Gliricidia maculata 12

H.

Harpagus bideutatus 104
Harpiprion cayennensis 106
Heliothrips indicus 55
Heliothrix auritus 99
Herpetotheres cachinnans 104
Hevea brasiliensis 18
Hibiscus cannabinus 121
Hints to Farmers, Practical— 226
Hints for the Home 130,228
Home Curing of Bacon 286

I.

Icterus croconotus 45
Icterus Xanthornus 45
Ictinia plumbea 104
Imperial Bureau of Mycology, The Work of the— 279
Indigofera aml 170
Inflamation 209
Informal Report on some Mora Sleepers in the Show Room of the Trade Commissioner for British Guiana ... 271

L. Page.

Lampornis gramineus 99
Lampornis violicauda 99
Larus atricilla 105
Lathyrus sativus 125
Leistes guianesis 46
List of Rice Padi Cultivated and under Experimental Test at the Experimental Fields, Botanic Gardens. ... 215

M.

Meetings of the Board of Agriculture 20,135,240
Meetings of the British Guiana Sugar Planters Experiment Stations Committee, Resume of Minutes of— 142, 251
Megarhynchus pitangua 48
Melanopsammopsis Ulei 18
Meteorological Data 65,133,232,308
Micrastur gilvicollis 104
Mimus gilvus 34
***Molothrus** atro-nitens* 35,45
Mosaic Disease among certain canes in the Colony, Reports on a suspected outbreak of Infectious— ... 216
Mycology, The work of the Imperial Bureau of— 279
***Mycteria** americana* 106
***Myiozetetes** cayennensis* 48

N.

Native Birds of Georgetown 20,93
Notes, Editorial— 1,69,237
Nyctherodius violaceus 106

O. Page.

Obituary, Sir Frederic Hodgson K.C.M.G., V.D. 270
Ochroma wagophus 14
Oryzoborus crassirostris 43
Ostinops decumanus 44
Ostinops torridus 44

P.

Panicum barbinode 17
Para jacana 106
Passiflora foetida 170
Phaethornis superciliosus 98
Phytophthora parasitica 3
Picumnus spilogaster 94
Pitangus lictor 47
Pitangus sulphuratus 47
Plant Physiology in Agriculture, The Role of— 113
Plants, Youth and age in— 181
Ploughs, Development of Manless— ... 128
Porphyrio martinicus 106
Porzana cayennensis 106
Practical Hints to Farmers 226
Present-Day Problems in Crop Production ... 51
Principal Varieties of Sugar Cane under Cultivation in B. Guiana 1923-24-25. 108
Progne chalybea 36
Progne purpurea 36
Progne tapera 36
Pulsotrix torquata 102
Pygmornis longuemareus 98

Q.

Quiscalus lugubris 46

R. Page.

Rhamphocoelus jacapa 39
Rhynchops nigra 105
Rice Padi cultivated and under Experimental Test at the Experimental Fields, Botanic Gardens, List of— ... 215
Report on a visit to Jamaica, Costa Rica and Trinidad. 2
Reports on a Suspected outbreak of Infectious Mosaic Disease among certain Canes in the Colony ... 216
Resume of Minutes of Meetings of the B. G. Sugar Planters Experiment Stations Committee 142, 251

S.

Sarcorhamphus papa 103
Sclerotium bataticola 284
Scops cristatus 102
Sir Frederic Hodgson K.C.M.G., V.D., Obituary 270
Sleepers, Informal Report on Some Mora— ... 271
Soil Hygiene in its Relation to "Disease" of Cane 256
Soil Water, The Evaporation of— 254
Spermophila castaneiventris 43
Spermophila lineata 43
Spermophila lineola 43
Spermophila minuta 42
Station, Cotton Research— 274
Stelgidopteryx ruficollis 36
Sterna magnirostris 105
Sterna Superciliaris 105
Sugar-Cane Cultivation 262
Sugar Cane under Cultivation in British Guiana, Principal Varieties of— 108
Sultator magnus 40
Sycalis flaveola 41
Sycalis minor 41

S.—(Contd.) Page.

Synallaxis ciunamomea 93
Syntherisma digitata 217
Syntherisma digitata 223
Syntherisma sanguinalis ... 217,223

T.

Tanagra episcopus 40
Tanagra palmarum 40
Thamnophilus doliatus 93
The Evaporation of Soil Water 254
The Role of Plant Physiology in Agriculture ... 113
The Leaching of Fertilisers from Soils ... 171
The Work of the Imperial Bureau of Mycology ... 279
The Value of Charcoal 83
Thryothorus coraya 35
Todirstrum cinereum 38,49
Tringoides macularius 106
Troglodytes furvus 35
Turdus albiventris 33
Turdus fumigatus 33
Turdus musicus 33
Turdus phaeopygus 33
Tyrannus melancholicus 48

U.

Urogalba paradisea 97

W.

Wembley, British Guiana at— ... 235, 292
Wood Preservative, Arsenated Petroleum as a— 70

X.

Xanthosomus icterocephalus 45

Y.

Youth and Age in Plants. 181

INDEX OF AUTHORS OF ORIGINAL ARTICLES.

Page.

Altson, R. A. 2, 216
Beckett, E. 71
Bird, M. 256
Bourne, C. L. C. 1, 142
Bruce, S. N. 209
Davis, L. S. 69, 237
Morgan, E. M. 226
Wood, B. R. 271

NOTICE TO AGRICULTURISTS.

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JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XVIII. JANUARY, 1925. No. I

EDITORIAL NOTES.

The article on birds commencing in this issue from the pen of that great naturalist Mr. J. J. Quelch is one that should be read by all lovers of bird life. As is well known, there is no scarcity of beautiful birds in this colony, and a fair proportion of these are also fine songsters, but it will surprise many to discover the variety of birds which exists in Georgetown and its environs. Mr. Quelch has taken pains not only to give clear descriptions by which most of the common birds to be met with in the city might be identified, but he has told us something of their habits, in many instances describing their song, and the simple yet attractive manner in which he has done this, makes the article as a whole a very interesting one.

We are glad to reproduce the Report by the Government Mycologist on his visit to Jamaica, Costa Rica and Trinidad. There is much of interest in what he has written on the methods of cultivation of various crops in these countries. We feel sure that our farmers will glean much useful knowledge by a perusal of this article.

Lastly we commend our readers' attention to the article by Sir E. John Russell on problems in crop production, in which agriculture in several of its more important phases is dealt with from the standpoint of modern science.

REPORT ON A VISIT TO JAMAICA, COSTA RICA AND TRINIDAD.

BY R. A. ALTSON, A.R.C.S. B.Sc.,
Assistant Government Botanist and Mycologist.

During the writer's brief visit to Jamaica in the early part of last year (for the purpose of attending the West Indian Agricultural Conference) and subsequent visits to Costa Rica and Trinidad he was able to secure some information in regards to agricultural conditions and practice in these areas which, as they may prove of interest to cultivators in this Colony, have been embodied in the following report *

Whilst the conference was in session the delegates were invited to visit the Government Farm and Experiment Station at Hope, At this Station the extensive trials which have been conducted with Uba cane as a stock feed have shown it to possess characters of such value as are likely to render its use for this purpose one of increasing importance.

Mr. H. H. Cousins (The Director of Agriculture) has pointed out that as a crop yielding 100 tons of material containing 12 per cent. of sugar on an acre of land it compares very favourably, from a cattle feeding point of view, with the best records of mangels in England or corn in the United States. This feature, combined with its capacity for resisting drought, and for growing on almost any type of soil, suggests that its cultivation for feeding purposes might, under certain circumstances, be worthy of consideration in this colony.

Much success has accompanied the use of trypanblue in the treatment of Texas fever. It is suggested that the failures experienced elsewhere have been due either to deterioration of the drug or unsatisfactory supplies. In Jamaica it has been found neccessary to import fresh material at frequent intervals from

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* An abstract of a report dated May 1924 and published as Sessional Paper No. 49, 1924

Germany, the British product being said to be unsuitable. When the temperature of the animal reaches 103-104 °F one hundred cubic centimetres of a 2 per cent. aqueous solution of trypan-blue, previously sterilised and allowed to cool to blood heat, are injected into the jugular vein. This process is repeated as soon as there is a further recurrence of fever. During the treatment it is important to give the animal all the liquid it can drink. The flesh becomes dyed blue and remains in this condition for about six months.

Seed has been obtained from a Uba-White Transparent cross and some of the plants now being raised look promising, but whether they will prove immune to mosaic disease has yet to be determined.

The "Black Jamaica" pineapple has been found to be highly susceptible to leaf-base rot, a disease said to be caused by *Phytophthora parasitica*. The "Ripley" variety is attacked but not so severely. "Red Spanish" appears to be immune.

I spent two days travelling in the south-western part of the Island and visited several estates. Much of the country bordering on the southern coast is of an arid nature, cacti, stunted logwood and gommier (*Bursera gummifera*) forming predominant features of the vegetation. I visited a banana estate, situated in this region, where the annual rainfall was in the neighbourhood of 8 inches. The crop is grown under irrigation, water being obtained from shallow wells 35 to 40 feet deep. The fertility of the soil combined with intensive cultivation result in remarkable returns, 85 to 90 per cent. of the bunches produced being standard, that is of nine hands.

Before planting the land is ploughed to a depth of nine to ten inches and harrowed. Two methods of planting are employed. On the best soil, suckers are put in at 14 x 14 ft. and three plants are allowed to develop from each root, on poorer land the planting distance is reduced to 11 x 11 and one plant only is allowed to grow.

Experience has shown that the direct application of manure is of no benefit to bananas, but that valuable results are to be obtainable by its indirect use; it is therefore applied to cowpeas which are sown between the rows of young plants and are eventually turned in. The rows are periodically cultivated with tractor or animal drawn implements and the field thus kept free from weeds. When three crops (one plant and two ratoons) have been harvested, the land is replanted.

The fields are irrigated about every three weeks the water being distributed from the main canals by channels forms in the centres of the rows.

Panama disease does not occur. Its universal absence on irrigated lands is attributed to the heating and drying to which the soil is subject between the periods of watering.

The price for standard bunches ranges, according to seasons, from 5/- to 1/6, the maximum being obtained in July.

Probably the most serious problem which sugar planters in Jamaica have to face at the moment is mosaic disease of cane. The evidence goes to show that the disease was originally introduced on canes imported from Java. It passed unrecognised for several years and becane firmly established in several parts of the island before it was detected. Vigorous efforts are now being made to eradicate it. In heavily infected areas the cultivation of the susceptible seedling varieties and White Transparent is being abandoned, and Uba cane is being planted in their stead. Where infection is lighter roguing of diseased plants is systematically practised. Nurseries for the production and and distribution of disease-free tops are being established in districts which have so far remained free from attack, and an ordinance prohibiting the growing of corn within 200 yards of any cane lands has recently (December, 1923) been brought into force, for the reason that this crop forms a favourable breeding ground from the insects which transmit the disease.

I visited two estates in the western end of the Island where, in both cases, the disease has reached such a pitch that it is estimated that 100 per cent. of canes are infected. The cultivations are situated in a sheltered valley subject to a fairly large rainfall and the spread of the disease in this region has been very rapid. This was well illustrated by an experiment carried out a year or so ago. A small island of virgin land lying in the middle of the river which flows through the valley, was planted up with tops brought from non-infected districts fifty miles away. By the time these plants were ready for cutting all were found to have become infected, the disease having spread across the river from the surrounding cane fields.

An idea of the loss that the disease is causing in this area can, perhaps, be best conveyed by quoting the words of a planter, Mr. F. L· De Pass, Manager of the Appleton Central Factory, who has been contending with it for the past eight years and who was good enough to summarise his experiences in writing. He has come to the conclusion that " it is possible to grow, " with intensive cultivation, a good plant crop but the " ratoons are, and always will be, a ghastly failure as " they will not benefit by either cultivation or the " application of manures, and after the first ratoons " are not worth keeping in. By careful roguing " an infection of less than 5 per cent. can be controlled, " but *not* eradicated. To do this it is neccessary to " have at least one man for every twenty acres, as, " after a couple of hours, colour blindness sets in. The " loss incurred from the one hundred per cent. infec- " tions that I have to contend with is not less than 50 " per cent., while the cost of cultivation is increased a " like amount. The reasons for this are not hard to " explain. The cost of an acre of plant canes, prev- " ious to this awful infection at this Western end " of the Island, was £10 per acre. This yielded from " 25 to 40 tons as plants, and ratooned for from 5 to 6 " years, being replanted when the yield dropped below

" 15 tons. Today it is quite impossible to produce any
" crop of plants at less than £20 per acre, this being
" due to the tops dying and so having to supply three
" or four times, then again they grow so slowly that at
" least seven weedings are required before they cover
" up ; and as I stated before only two cuttings are
" obtained."

It would be apparent from the foregoing instance alone, were additional evidence not available from other cane growing countries, that mosaic disease can have the most serious consequences under conditions favouring its spread. In Java it has caused a loss of tonnage in some cases of 50 per cent and losses of from 30 to 40 per cent. have been recorded from Porto Rico. Although the introduction of the disease into the West Indies is of comparatively recent date, its distribution has been so rapid that it is now present in most of the Islands. It was first noticed in Porto Rico in 1916 but not recognised as a mosaic disease until 1919, when more than three-quarters of the cane growing area had become involved. In 1918 it was found in Santo Domingo and St. Croix and a year later reported from three separate points in Cuba. It was recognised in Jamaica and Trinidad early in 1920, and has since made its appearance in Barbados.

It was doubtless due to the circumstance that the disease had been present in some of these Islands for several years before its nature was understood, that the invasion became so general and its effect so severe. The control or eradication of a newly introduced disease is naturally facilitated by its early recognition, and this is so in the case of cane mosaic, for experience has shown that control by roguing is only practicable providing infection is not allowed to exceed 5 to 15 per cent., this proportion depending on the extent of the area involved. Again, the material losses resulting from this infection are unduly increased by unconscious neglect. The disease can be spread in two ways. By the planting of infected tops (primary infection) and by insect transmission (secondary infection). The loss of tonnage due to primary infection is considerably in excess of that due to secondary infection, for in the former case the plants are subject to the effects of the disease from the initial stage of their growth. It is clear that the proportion of primarily infected plants will be greater in a region where the disease has passed unrecognised for several years, and where consequently the selection of healthy planting material has not been practised.

Cane mosaic has not yet been reported from this Colony but the disease is known to be present in Surinam, and this circumstance, considered in conjunction with the above facts, suggests that it would be advisable to carry out a detailed inspection of the cane cultivations here so as to make certain that unrecognised introduction have not occurred.

In the course of my journey in the Island I visited a sisal estate in the neighbourhood of Maypen where about 3,000 acres are under the cultivation of this crop. The annual rainfall in this district ranges from 25 to 30 ins. The methods of cultivation employed is briefly as follows. The land is cleared of the existing light scrub. The suckers are then planted out in rows at a distance of about 6ft. in the row, the rows being 8ft. apart. For the first three years the fields are cutlassed twice a year, at the end of this period cutting begins and from this time onwards only one annual weeding is given. The plants "pole" when about seven or eight years old and are replaced by suckers. Two cuttings are made a year, and an acre is estimated to give half-a-ton of fibre in that period.

The cost of extraction of the fibre has been a serious drawback to this industry in many parts of the world, and it has been recognised that the considerable labour and expense involved in transporting the green leaves (the weight of which is so great in proportion to the yield of the fibre) to the factory, is in a large measure responsible for this. Many attempts have been made to devise portable machines which, by stripping the leaves in the fields, would overcome this difficulty, but few if any of these have been successful.

I saw in operation on this estate a portable machine, recently designed by one of the proprietors, which may go far in solving the problem in question. I understand that it has very favourably impressed several experienced sisal planters who have seen it, and that it will shortly be operating in sisal growing areas outside Jamaica. This machine, which is being put on the market under the name of "The Anderson portable decorticator" at a price of £100 f.o b. Kingston, has a daily capacity of 600 lbs. of fibre. It is belt driven by a 6 H.P internal combustion engine, and the entire unit, being mounted on a small-wheeled trolley, is capable of reasonably easy movement through the fields.

The freshly extracted fibre is hung to bleach and dry in the fields, agave "poles" stretched across standing sisal plants being utilised as racks for this purpose. The pulp or waste material from the leaves is returned to the rows to act as mulch and manure. A rope factory is situated on the estate which was erected at the cost of about £4,000 and has an output of 2½ tons of rope a week. Its entire production is at present sold on the local market where it fetches 50/- per 100 lbs.

I left Jamaica for Costa Rica on the 4th of February for the purpose of visiting the United Fruit Company's cultivations in this area. On my arrival in Port Limon I met Mr. Samuel Kress, the Superintendent of Agriculture for this division, who very kindly made every arrangement for my convenience and under whose direction I was able to spend a most interesting and instructive week.

The Company's operations are almost entirely confined to the Atlantic seaboard. Port Limon their main outlet on the Atlantic side is connected by railway with San José, the capital of the Republic, which lies about 100 miles inland on a plateau 3,500 ft.

above sea level. The cultivations are situated close to this main railway and are themselves intersected by an intricate system of branch railways and tramways. For the purpose of administration they are divided into "farms" of from 5,000 to 8,000 acres in extent and each "farm" is under the direct supervision of an Assistant Superintendent. Jamaican negroes form the bulk of the labour, though in the districts further inland and at higher altitudes *peons* are more extensively employed. Wages are high, the ordinary labourer receiving one American dollar a day.

The character of the soil appears to be fairly constant in the cultivated areas. It is a loam of light to medium texture ranging in depth from 3 to 5ft. and underlain by a coarse gravel subsoil. Excellent natural drainage obtains. The rainfall is heavy, varying from 120 to 150 inches per annum, but as it is evenly distributed throughout the year no marked wet or dry seasons occur.

Whilst the growing of bananas and cacao forms the most important part of the company's operations in this division, they are also concerned with the cultivation of pineapples, citrus fruits, balsa (corkwood) and coconuts, and their influence extends into the coffee-growing districts of the interior.

The banana lands were originally restricted to the coastal plains, but the ravages of Panama disease, which first made its appearance here early in the present century, necessitated, from time to time, the abandonment of large areas in this region, and consequently the cultivations have gradually been carried inland until now in some cases they occupy plateaux, in the foot hills of the dividing range, 2,500 to 3,000 feet above sea level.

The possibility of obtaining a variety of banana which will combine resistance to the disease with those characters which at present appear to place the Gros Michel in a class by itself, in so far as an export trade is concerned, has not been lost sight of. A number of the commoner varieties have been tried and have failed, Several acres have recently been planted up with the Lacatan, a resistant variety hailing from the Philippines. and it now remains to be seen whether its shipping qualities will come up to the required standard. I understand that experimental shipments are also to be made with the variety which is now arousing interest in Jamaica—the Robusta or Giant Fig.

It may not be out of place to mention here some information which I received in regard to the shipping of the Canary or Chinese banana. This variety is highly resistant, if not immune, to Panama disease and possesses a flavour which is considered far superior to that of the Gros Michel, its one serious drawback being its poor carrying quality. For shipment to European ports, the bunches have to be wrapped in cotton wool or some similar material and packed in crates, and the extra cost of transport that this involves considerably restricts the market for this type of fruit. Were it not for this disadvantage, there seems little doubt that the good points of this variety would have weighed so in its favour that the Gros Michel would eventually have been ousted from its dominant position, and the establishment of a banana industry would, perhaps, have been made possible in countries where, under existing circumstances, the presence of Panama disease renders this out of the question. One of the shipping companies mainly concerned in handling the trade in Canary bananas has, for some time now, been investigating this problem of packing and as a result has recently adopted a new method which I understand is proving very successful and is having the effect of reducing transport costs. This method is very simple and consists in wrapping the bunches in blankets tied round with tapes and shipping them in this way uncrated. In obtaining a cheap supply of blankets, advantage was taken of the large surplus stocks held by the Imperial Government at the conclusion of the War. When the bunches have been landed, the blankets are removed and baled, and returned for further use.

The methods employed in the cultivation of bananas in Costa Rica are in striking contrast to the intensive measures adopted on the irrigated lands in Jamaica. The suckers are put in at a distance of 15 x 15 feet. The fields are cutlassed about every four months until the plants have grown sufficiently to cover up the soil. All adventitious suckers are allowed to develop, and the land eventually becomes clothed with a veritable forest of bananas. Drainage, but for a few main drains, is entirely dependent on the natural features of the soil. Manures are not applied. I visited a farm of some 9,000 acres, in the Estrella valley, which is fed and intersected by seventy-five miles of railway and thirty miles of tramway. The average production per acre over this area is 210 bunches a year, of which 80% are standard. This high yield is remarkable in view of the fact that the land has been continuously under bananas for ten years, and has never been replanted. Although Panama disease has been present in this district for several years it does not appear to have made much headway, and on this account the control measures which have been adopted are of particular interest. In order to prevent the dissemination of the disease through the agency of contaminated machetes, the practice of cutting out diseased plants has been entirely abandoned and instead the infected area is isolated from the healthy plants by establishing a protective belt of the "claret" banana, a quick growing and resistant variety, whose fruit at present finds a small but slowly expanding market in England and the United States. Thick growth is also encouraged, for it is maintained that the resulting high soil humidity inhibits the spread of the disease. It is not at all clear how this factor operates, for it is diametrically opposed to those which are held to account for the absence of the disease on irrigated lands.

The Company's cacao cultivations although of comparatively recent origin are extensive, and cover an area of some 27,000 acres. Cacao was the crop originally selected to occupy sections which had to be abandoned on the account of Panama disease, and all the land on which it is now grown has been at some time or the other, under bananas. The trees, which have been planted at stake at a distance of 12 x 12 feet, vary in age, but the majority are now from seven to eight years old and are therefore just coming into full bearing. The bulk of the fruit is of the Forastero-Calabacillo type, some Criollo occurs. Shade is provided by a species of *Inga* (probably *edulis*) known locally as "guabo." Oronoques (*Erythrina glauca*) and Nicaraguan shade (*Gliricidia maculata*) have in some instances been grown for this purpose but are likely to be replaced by guabo, for which a strong preference is held on account of its freedom from epiphytes and the absence of the brittlenesss which characterises the oronoque.

The fields are cleaned with machetes about three times a year. Natural drainage, as in the case of the banana cultivations, is relied upon to remove surplus water. Pruning until quite recently was not practised but this question is now being taken in hand. Pod-rot is present but to no marked extent. A form of bark-rot or canker, bearing a resemblance to the *Sphaeronema* disease described by Rorer from Ecuador, takes on a serious aspect. The incidence of the disease is closely associated with machete wounds, and owing to the prevalence of this form of injury at ground level the bases of many of the trees become infected. The infection at length spreads to the roots and results in the death of the tree.

The fields are picked once a week and the pods brought out on pack mules or "burro cars" (mule drawn trams) to central depots situated on the railway, here they are broken and the beans, loaded into bags are transported to Limon where they are fermented in wooden sweat boxes and dried in Gordon driers.

As the result of research carried out in the Company's laboratories in Boston, it is claimed that a process has recently been perfected whereby it will be possible to produce a bean of any type irrespective of its origin; that is, a product having all the characteristics of, say, Java or Arriba cacao can be turned out from beans grown in Costa Rica.

I was informed that consequent on the low cost of production the Company, if necessary, is in the position to put cacao on the market at six American cents per pound.

Pineapples are grown in the Columbiana district at an elevation of 300 ft. on land which is now under cultivation for the first time, and occupy an area, at present of about 700 acres, which is being gradually extended.

After the land has been cleared of the dense forest growth which covers it, it is ploughed and harrowed, the implements being drawn by 5 ton Holt tractors. The slips are planted on the level in double rows at a distance of 18 by 18 inches, the plants in one row being alternated with those in the adjacent rows. The double rows are 5 ft. apart. Slips from the base of the fruit are used for propagation. Plants from this source are slow in coming into bearing taking 18 months to two years before they yield fruit, but a sufficient supply of suckers is not at present available. Young plants are intercultivated with light tractor drawn Planet Jr. cultivators.

The varieties grown are Red Spanish, Chicona (an introduction from Tobogo, an island in the Pacific off the coast of Panama), and Santa Clara, a smooth leaved variety obtained locally from the Turrialba district. The Santa Clara is said to possess a very fine flavour but is proving somewhat susceptible to a disease known there as crown rot (which, judged by external symptoms, closely resembles the leaf base rot of Jamaica) and for this reason its cultivation is being restricted. The other two varieties appear to be resistant. All the three varieties, however, are subject to the black spot disease which affects the ripening fruit. The fungus associated with this disease, a species of *Penicillium*, is thought to obtain access to the tissues of the fruit through punctures made by mites in the base of the flowers, and on this account, dusting with sulphur is being employed as a means of control against the mite, but so far without much success for under field conditions it has been found difficult to secure effective penetration of the floral cavities by the insecticide.

Balsa or cork-wood (*Ochroma Wagopus*) is grown over an area of some 5,000 acres of land which has been found unsuited to cacao. This timber is employed in the manufacture of life belts and rafts, and as an insulating material in the construction of cold storage chambers and refrigerators. During the war it was in great demand for the former purpose and its cultivation was then exceedingly profitable, but there has since been a severe decline in prices with a consequent diminution in returns.

The trees are planted at stake 25 to 30 feet apart and are felled when about six years old. Careful experiments have been conducted in order to determine the best planting distance. It was found that while close planting produced a desirable form of tree—straight and free from low branches—the extra growing time required for it to attain the necessary girth resulted in the production of timber which exceeded the market specifications in regard to weight per cubic foot. A fungus disease occurs which attacks the tree at its base and eventually kills it; the fungus has not yet been identified.

The main area under citrus fruits is near Paraiso about 20 miles from San José where oranges and grapefruit are grown at an altitude of 2,500 to 3,000 feet. The cultivations, which lie in well sheltered valleys, are some distance from the main railway from which they are separated by rather broken country. All the fruit is shipped to the Canal Zone; owing to the presence of Black Fly in this area importation into the United States is only possible under permit.

Coconuts have been planted in several districts on abandoned banana land but appear to have made unsatisfactory progress and are now in some instances being replaced by cacao. "Bud-rot" is present. Red-ring disease has not yet been observed.

The cultivation of coffee (*C. arabica*) forms the chief industry of the interior where this crop is grown over large areas at altitudes ranging from 2,000 to 4,000 feet. The soil in this region is of volcanic origin, dark brown to black in colour and of considerable depth. The estates are for the most part situated within easy access of the railway. The trees are planted in rows twelve feet apart at a distance of six feet in the row. The fields are cleaned with machetes and the weeds piled in the centres of the rows where they lie until sufficiently decomposed when they are returned to form a mulch around the base of the trees. Systematic pruning is not practised but tall or unhandy trees are periodically cut back. *Erythrina corallodendron* is planted as a wind break. Guabo and bananas form the main source of shade. The fruit from the latter is sold to the United Fruit Company, and I was informed that on many estates the profit derived from this transaction pays for the cost of cultivation of the coffee.

The Fruit Company operates an estate at Turrialba where the elevation (about 2,000 ft.) is considered to be at its lowest limit for the satisfactory cultivation of this crop, and even at this level the coffee is of an inferior quality to that produced at higher altitudes, and on this account fetches a poorer price; an increased yield per acre is said to compensate for this disadvantage.

I was not able to visit any of the cane growing areas for these are situated on the Pacific slope where the existence of a well defined dry season favours the cultivation of this crop. I learnt, however, that White Transparent and Red Ribbon are the varieties more generally grown. The sugar is refined locally. The manufacture of rum is a government monopoly.

I left Costa Rica on the 14th of February and reached Trinidad on the 25th.

Through the kindness of Mr. W. Nowell, Acting Director of Agriculture, who, during my stay in Trinidad, showed me every consideration, I was able to visit several cultivation in various parts of the Island. Mr. F. W. Urich, Government Entomologist, and Mr. F. Stell, Government Mycologist, were good enough to accompany me on several of these occasions.

The method employed in the cultivation of cane in Trinidad differs in many respects from those practised in this Colony. The fundamental points of difference naturally owe their origin to the dissimilarity in geographical features, but this circumstance would not seem to account for all. The brief outline which follows refers mainly to the method adopted on some of the larger estates; on farmers' lands, which represent a considerable proportion of the cane growing area and produce very nearly one half the total crop, hand labour is still largely employed and consequently the modification which have been brought about by the use of implemental tillage have not made their appearance.

Roads and railways provide the means of communication between the fields and the factory, and the condition of the roads through the fields has an important bearing on the duration of the grinding season, for soon after the rains begin they become more or less impassable and adequate supplies of cane can no longer be brought out.

The land is ploughed and harrowed before planting. On an estate in the central district, balance ploughs operated by a steam driven cable outfit are used, and under favourable conditions six to eight acres are ploughed in a day. Animal drawn ploughs are employed on the undulating lands on the Southern Plain but these, I understand, are likely to be replaced by tractor driven implements. The beds are comparatively flat, 25 to 30 feet wide and separated by shallow drains. The rows which run parallel to the drains and are five feet apart, are opened by means of a mould board plough the bottom of the furrow being cultivated with a "sub-soiler." The tops are put in 2 ft. 6 ins. to 3 ft. apart, 2,700 to 3,000 tops being required to plant an acre. In this Colony owing to the close system of planting which prevails, the number necessary for the same area ranges from 7,000 to 8,000. Pen manure is applied to plant canes and sulphate of ammonia to ratoons. Some estates keep animals in excess of their transport requirements in order to meet the heavy demand for manure, and in one case at least, pens have been constructed on the lines evolved in Mauritius by the use of which it is estimated that the amount of manure produce by a given head of stock is increased five times

Fields are not fired before cutting except in cases where Uba cane is grown. Implemental intercultivation of fields of young cane is practised. Para grass (*Panicum barbinode*) and nut grass (*Cyperus rotundus*) are the most serious weeds and considerable trouble has been experienced at times in ridding land of the former. Among the varieties cultivated, B. 156 and D. 109 appear to predominate. Uba cane is being grown on several estates and is likely to claim increased attention in the near future. I was informed that it is giving similar returns to those obtained from the standard varieties (about 2 tons of sugar per acre) at a lower cost of cultivation, and, contrary to the statement made elsewhere, has not been found to cause any difficulty in the factory; it should however be mentioned that the factory from which the latter information was obtained is provided with shredders.

Mosaic disease has a fairly wide distribution, but as systematic roguing was adopted soon after its first appearance it has been kept under satisfactory control. The damage done by small moth borer appears to be slight. In the central district a considerable area of land formerly under cacao has recently been cleared and planted to cane, and I understand that, consequent on the depression in the cacao industry, this tendency is likely to increase in those cacao areas which are situated within reasonable distance of sugar factories.

I visited several coconut cultivations. Red-ring disease is found throughout the island and is capable of causing severe losses on plantations which are just coming into bearing. A form of "bud-rot" outwardly similar in appearance to that which occurs in this Colony, was observed on one or two small cultivations. A less serious affection known as little-leaf disease, which has not so far been recorded from this Colony, appears to be not uncommon. The leaves become aborted and in advanced cases the entire crown much reduced and stunted. A yeast is found to be associated with this condition but has not yet been proved to be its cause. The disease is said to be easily controlled; the strainers are severed, the congested leaf bases opened out, and some diluted disinfectant such as formalin, copper sulphate solution, or tobacco extract is poured into the heart. Recovery follows this treatment in the majority of cases.

Brassolis sophorae, the leaf-eating caterpillar, which is here responsible for such heavy injury to trees, is present in Trinidad but is so effectively held in check by parasitic insects that it can, at the most, only be regarded as a minor pest.

A new, and at present undescribed form of coconut injury has recently made its appearance in the Island. The insect which is causing the trouble is a leaf-eating caterpillar belonging to the family *Limacodidae* and its operations are at present confined to one estate. The opinion has been expressed that this isolated outbreak is due to the temporary escape of the insect from the attentions of its natural enemies, for it is commonly found in coconut cultivations but normally is heavily parasitised and thus rendered incapable of doing any appreciable damage.

I was interested to notice South American leaf disease of rubber caused by the fungus *Melanopsammopsis Ulei* occurring on some seedling *Hevea brasiliensis* and was informed that it is found commonly in Trinidad on the leaves of young plants but seldom if ever, on mature trees. The reason for the freedom from infection of the older trees in spite of the susceptibility of the seedlings would appear to be related to the question of atmospheric humidity. Dr G. Stahel, working in Surinam, has found that for the fungus to secure infection by means of its conidia a coating of dew on the leaves must necessarily be present, and that on this account the disease spreads rapidly and becomes epidemic within a very short time in cultivations which are subject to enveloping mists, whilst on the other hand, those which are in positions exposed to the influence of the trade winds are less liable to infection. In Trinidad rubber is grown in districts which. I understand, are at the most only subject to low ground mists.

Cane breeding is carried out at the St. Augustine Experiment Station where a considerable number of new seedling varieties are being grown. It has been found that certain of the standard canes never, under any circumstances, produce progency of value, and breeding from these is therefore being discontinued. Some seedlings which are regarded with favour have been raised from Hawaiian parents.

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MEETING OF THE BOARD OF AGRICULTURE.

A Meeting of the Board of Agriculture was held in the Court of Policy Hall on Tuesday, the 3rd of February, 1925. His Excellency the Governor, Sir Graeme Thomson, K.C.B., presided, and there were present The Hon. Sir John Harrison, C.M.G. (Director of Science and Agriculture), Chairman, Hon. R. E. Brassington, Hon. J. J. daSilva, Messrs. W. Francis (Assistant Director of Science and Agriculture), R. Ward, M.B.E. (Superintendent of Botanic Gardens and Agricultural Stations), Captain Edgar Beckett (Deputy Director of Agriculture for Essequebo), Dr. C. L. Whittles (Superintendent of Sugar Planters' Experiment Stations), Messrs. L. D. Cleare, Jr. (Government Economic Biologist), A. Seton Milne (Government Veterinary Surgeon), Chas. Shankland (Director of Co-operative Societies), S. H. Bayley, Thomas Earle, H. L. Humphrys, E. M. Walcott, R. Strang, C. R. Williams, H. A. Britton with E. M. Peterkin, Secretary. Mr. R. A. Altson, (Assistant Botanist and Mycologist) was also present.

Excuses for unavoidable absence were received from The Honourable R. Popham Lobb, C.M.G., Colonial Secretary, The Commissioner of Lands and Mines, G. E. Anderson, Esq., W. M. B. Shields, Esq., and Dr. F. Wills.

The minutes of the previous meeting held on July 29th, 1924, having been previously circulated to the Members of the Board, and having received their approval, were on the motion of the President, seconded by the Chairman, taken as read and confirmed.

The Chairman reported that Dr. C. L. Whittles, Superintendent, British Guiana Sugar Planters' Experiment Stations, had been appointed a member of the Board.

The appointment of the Honourable J. J. da Silva as a member of the Board was reported.

The resumption of duty from leave of absence of Mr. W. M. B. Shields was reported.

Leave of absence granted to Mr. E. M. Walcott and his resumption of duty was reported.

Resumption of duty of Mr. W. Francis, Deputy Chairman and of Mr. E. M. Peterkin, Secretary was reported.

The Chairman reported the resignation of Mr. B. Gainfort, Chief Commissary, on his retirement from the Service, Mr. Gainfort has been one of the Board's oldest and most energetic members.

Mr. H. L. Humphrys proposed, seconded by Mr. E. M. Walcott, that the Governor be asked to appoint Mr. Gainfort an Honorary Member in recognition of his services: this was unanimously carried.

The Chairman reported that permission had been granted Mr. H. L. Humphrys to export six bird skins.

The Chairman in reporting the arrival of two stallion donkeys said that the two donkeys were downstairs for inspection, they were very fine animals and had cost $1,353 to land them in the colony, their first cost in Texas was $625, each.

The Chairman reported that Waterbass had been stationed at Belfield since the 30th of October, 1924, up to date; he had been moved along the coast but had obtained no service, two of his foals were downstairs so that they could see the kind of foals he produced.

Mr. Walcott said that he hoped soon to be able to make use of him; he considered some of his foals splendid specimens.

His Excellency expressed his satisfaction with the foals.

The transport of the four young horses from the D'Urban Stud Farm to the Police Department was reported.

Mr. Brassington said that he should like to know what these animals cost to produce so as to ascertain if the scheme was a success.

The Chairman replied that accurate figures could not be obtained until they were turning out larger numbers.

The Chairman informed the Governor that the term of office of Mr. Seton Milne, Government Veterinary Surgeon, as a member of the Board had expired and that he could not take his seat unless he was re-appointed. His Excellency thereupon re-appointed Mr. Milne and asked him to take his seat on the Board.

The Chairman reported the death of an imported ram sheep whilst stationed at Pln. Hope; Mr. Walcott had offered to defray the cost of importation of the animal, but as these animals not infrequently died soon after their importation wherever they were stationed, he did not think that Mr. Walcott should be called upon to do so; this was unanimously agreed to.

The Chairman reported the nomination of Mr. D. D. Haynes as a British Guiana Agricultural one-year student at the Trinidad College. Mr. Haynes had given excellent services as a part time Agricultural Instructor, and it was greatly to his credit that he had gone to take the course. Mr. Haynes would only get half salary and would be a pecuniary charge on himself

Mr. Walcott said he thought something should be done for Mr. Haynes.

His Excellency said that Mr. Haynes was not paying any fees, but he thought that if the Board would make a motion that some further consideration be given Mr. Haynes the matter might be placed before the Combined Court.

Mr. Walcott moved that the Board recommend for His Excellency's consideration, and for the consideration of the Combined Court, the granting of a special sum of money to Mr. D. D. Haynes to allow him to pursue his studies at the Imperial College of Tropical Agriculture, Trinidad.

Mr. Britton seconded this motion which was carried.

The transfer of the money in the Savings Bank from the previous Essequebo Show to the 1925 Essequebo Show was reported.

The following were laid :—

Journals of the Board of Agriculture, Vol. XVII. Nos. 3 & 4.

Report on the East Coast Farmers' Competition.

Report on Agricultural Show of the Buxton and Friendship Farmers' Association held on 19th August, 1924.

Report on Agricultural Show of the West Bank Farmers' Association held on 28th October, 1924.

Report on Agricultural Show of the Mahaicony Farmers' Association held on 4th November, 19 .4.

Estimated Rice crop for 1924, 52,000 acres at 16 bags per acre 830,000 bags, certainly 600,000 bags.

Estimates of Expenditure, 1925,

List of Registered Veterinary Surgeons for 1925.

The Board ruled that it could not remove a name from this list except in the case of death or at the request of the person so registered. It was decided that Mr. John B. Best who had returned to the Colony after a prolonged absence should be replaced on the list according to section 11 (3) of Ordinance 5 of 1920.

Certificates of competency were issued to the Following Agricultural Apprentices, who had completed their training at the Botanic Gardens :—

E. R. Collins	...	21/8/20—21/6/24
G. Europe	...	27/8/20—27/8/24
A. W. Sears	...	2/8/20—2/8/24
G. L. Leitch	...	7/11/20—7/11/24
G. E. Fraser	...	7/2/21—7/2/25

Mr. Britton's question and resolutions which were unavoidably left over from the last meeting were then dealt with.

Mr. Britton's Question.

That in view of the possibility of His Excellency's Government initiating in the near future schemes of drainage and irrigation and the necessity that exists to cultivate a love of agriculture in the rising generation of the country, His Excellency be requested to make alteration in the Board of Education Ordinance to allow Professor Sir John Harrison, Chairman of the Board of Agriculture, a seat to advise the Board of Education as regards a change in the curriculum so as to allow practical instruction in Agriculture to the boys and girls of our Primary Schools.

His Excellency said he was entirely in sympathy with the member but he was afraid that the Director had no time to take a seat on the Board of Education. On the other hand the Education Department had the opportunity of getting his advice and the Education Commission which was sitting at present had had very fully the advice of the Director on the precise point raised by Mr. Britton. He was sure they would give consideration to his views in the matter in framing their report.

MR. BRITTON'S RESOLUTIONS.

1. That the Government be respectfully requested to introduce a Cane-farming Ordinance.

Mr. Britton said he would not proceed with the motion because the British Guiana Sugar Planters' Association was conferring with a committee of the Farmers' Conference on the subject and it was hoped that a working scheme would be evolved.

2. That with a view to the fostering of Minor Industries and the preparation of Articles along Commercial lines for export, the Government be requested to place on the Estimates a sum of not less than $25,000.00.

Mr. Da Silva seconded the motion.

Mr. Brassington referred to the history and working of the Vegetable Products Factory and Mr. Walcott expressed himself against so ambitious a scheme.

His Excellency suggested that a more concrete and workable proposal might be prepared for the Board's consideration.

Mr. Britton withdrew this motion.

3. That the Government be requested to place on the Estimates a sum in the opinion of the Director of Science and Agriculture sufficient for the resuscitation of School Gardens which should be placed under the control of the Department of Science and Agriculture.

His Excellency said that the matter had received particular attention at the hands of the Education Commission.

Mr. Britton withdrew this motion.

4. That the Director of Science and Agriculture be directed to communicate with the British Cotton Growers' Association in writing them to supply men for the establishment of Cotton growing in the Colony.

His Excellency said that a good deal on this subject had been published in the last issue of the Journal of the Board.

Mr. Britton withdrew this motion.

1. That this Board recommends to Government the urgent necessity for the appointing of a Committee or Commission to enquire into and report as regards the desirability of founding an Agricultural Bank.

Mr. Britton said there would be hardly any necessity for this motion if effect was given to Ordinance 20 of 1896. The need for an Agricultural Bank was felt by the farmer who went in for the cultivation of permanent crops which took some time to grow. Trinidad had recently established such a bank and there was one in Jamaica while the Gold Coast was calling for one.

Mr. Walcott seconded the motion, strongly backing it and suggested that in years to come such banks might even one day be of service to the Sugar Industry.

Sir John Harrison said that Barbados was a striking illustration. In that island in 1903-04 the Home Government made a grant to tide over the period until the sugar bounties came to an end. An Agricultural Bank was founded with this money. That bank had been the salvation of that colony in respect of the small plantations and it also had greatly helped the large ones. It thus was financed origanally with money from the Home Country. Unfortunately in this Colony the money similarly granted was used otherwise.

Mr Shankland pointed out that the Trinidad bank was really a board of three members who considered applications from the owners of cacao estates for aid to carry them through one crop period. It was not the very small man who needed help, but the man who would cultivate 20 or 100 acres in the Pomeroon or North West District and wanted help and could not get it from the local banks.

His Excellency proposed that a small Committee be appointed to investigate and report on this matter; this was unanimously carried.

His Excellency appointed Mr. Shankland the convenor of this Committee and instructed him to confer with the Director of Science & Agriculture and himself as to the selection of its members.

2. That this Board requests the Director of Science and Agriculture to formulate a scheme with respect to students nominated by Government for tuition at the Imperial College of Tropical Agriculture.

Sir John Harrison said that the matter had engaged the attention of the Education Commission and no doubt would be fully reported on in their report.

Mr. Britton said that in view of this statement he withdrew his notion.

Sir John Harrison moved seconded by the Government Veterinary Sugeon the appointment of inspectors for the various districts under section 17 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance No. 5 of 1920 as under:—

DEMERARA.

Vreeden Hoop to Vriesland	...	R. B. Hunter
Craig Village to Georgetown and Georgetown to Buxton		Government Veterinary Surgeon
Mahaicony to Berbice River	...	E. Gordon

BERBICE.

East Bank, Berbice River, New Amsterdam and the Corentyne Coast as far east as Tarlogie. ...	E. M. Morgan
Tarlogie to Corentyne River ...	E. Essex

ESSEQUIBO.

Taymouth Manor Eastward to Aurora	Capt. F. Beckett
Wakenaam	J. E. Wilson
Leguan	W. Whyte

Up to the present no one had consented to act in the Essequibo River to Vreed-en-Hoop and Buxton to Mahaicony Districts in the County of Demerara. The motion was unanimously approved.

The Chairman moved seconded by the Honourable J. J. Da Silva that the vote XXXVIII :—Science and Agriculture 59. Grants-in-aid of Agricultural Associations, Exhibitions and Competitions be allocated as under :—

Essequibo County Show	$750
Buxton & Friendship Farmers' Competition	$100
Belfield Show	$130
Mahaicony Show	$150
West Bank Show	$150
Departmental Expenses	$120
Affiliation grants	$150
	$1,550

This was unanimously carried.

Application from Buxton & Friendship Farming Association for a grant-in-aid of a Farming Competition to be held in 1925 was read and $100 for a Farmers' Competition was approved as allocated.

Application from Buxton & Friendship Farming Association for the Board to give a written guarantee for a market for Castor Oil and Cotton was next considered and the Secretary instructed to inform them that the Board was unable to do so.

The Chairman proposed seconded by Mr. H. L. Humphrys that the new Black Stallion Donkey be stationed in in the Berbice and Corentyne District, and the red roan in Essequebo from Aurora to Anna Regina and be under the charge of Captain E. Beckett; this was agreed.

Mr. Da Silva moved that the Board import another donkey similar to the one assigned to Berbice for the West Coast and West Bank of Demerara.

Mr. Beckett seconded this motion and it was unanimously carried.

An application from the Beterverwagting & Triumph Farmers' Association for a grant-in-aid of an Agricultural Show to be held in April, 1925, was next discussed and the Secretary instructed to write and inform the Association that the Board was unable to grant their request.

The Chairman said that he had spoken to His Excellency with regard to offering special prizes for exhibits suitable for sending to the Wembley Exhibition this year and His Excellency had kindly consented to set aside $250 from the British Empire Exhibition funds for this purpose.

Sir John Harrison said that as regards the proposed amendment to Ordinance No. 5 of 1920 in connection with the importation of dogs into the Colony the Attorney General was preparing a draft of the amendments to the ordinance. In those amendments the owner of a dog would be responsible for allowing it to come of a ship on shore.

In connection with the Plant Pest Ordinance, coconut pests and inspection of the cultivation of coconuts, Sir John Harrison moved that a salaried agricultural inspector be appointed to look after the cultivation of coconut trees alone. He thought that the appointment could be filled locally.

Messrs. Strang and Brassington spoke on the dreadful condition the coconut cultivations were in, and suggested that if an efficient man could not be obtained locally he should be sought for out of the Colony.

Mr. Brassington emphasized the importance of thorough cultivation and drainage.

His Excellency said that the salary of the officer might be fixed at £250 to £300 per annum, and that the Combined Court would be asked to provide the salary of the officer and it would be done by supplementary estimate. The appointment, would, however, be left to Sir John Harrison who would select no other but a fully qualified officer.

The Board fixed the price of fowls (Plymouth Rocks and Leghorns) at $1.50 for cockerels and $1.00 for pullets.

It was decided to hold the meetings of the Board in January, May and September.

His Excellency then adjourned the meeting to a date in May to be fixed later.

NATIVE BIRDS OF GEORGETOWN.

BY J. J. QUELCH, B.SC., LONDON, C.M.Z.S.

GEORGETOWN offers a by no means uninteresting field to the ornithologist. Owing to its large extent and the marked abundance of plants of all sorts and sizes, in all parts of the town—due especially to the existence of large public and private gardens, thickly stocked with a tropical luxuriance of dense creepers, bushy flowering shrubs and tall palms and other trees, the greater proportion of which are of considerable size, together with open grassy spaces and wide streets lined or divided with wide trenches of water and dotted with trees, and to the proximity of large tracts of uncleared bushy land, there is afforded not only most perfect shelter and protection for the growth and multiplication of the feathered races, but most ample opportunities for their procuring constant supplies of fruits and insects and other animal and vegetable food.

Of the total number of birds recorded from the Colony (nearly 700 distinct species) about one-seventh may be obtained in or about the neighbourhood of the town, though not a few of these are only met with at rare intervals, and then only on the outskirts, or are seen flying overhead.

As would naturally be expected, the normal residents, with the exception of the carrion-feeding species, are chiefly birds of small size; and to a large extent they represent the typical families of the great group of the Passerine or perching birds, a very great many of which are broadly characteristic of this zoological district only. By means of a study of such forms, one is thus enabled to become familiarised with the chief of those large specialised groups distributed over the districts of tropical America.

As is already widely recognised, there are to be found widely scattered over the various parts of the colony, and by no means sparsely, some of the most ornate and beautiful of the birds of the world; but our town birds scarcely give an idea even of such excellence, though a few of them are by no means wanting in beauty of coloration. Of such may be mentioned the various species of humming-birds, the grass canaries (*Sycalis* sp.), the bastard canaries or louis d'or (*Euphonia* sp.) the blue and cashew sackies (*Tanagra* and *Ramphocoelus*), the so-called robin redbreasts (*Leistes*), the yellow-plantain birds (*Icterus*), and the swallows (*Progue* sp.), while many others, though not brilliant, are yet sufficiently pleasing in appearance.

While there is this marked disproportion, however, between the town and forest birds as regards their colouring, there is little difference to note between them as regards their song. In and about town, the mellow notes of the thrush, and the brilliant warbling of the wren can be heard to as great, if not greater, advantage, than in the country districts generally, while the pleasing twittering and whistling of many of the small birds, such as grass canaries, and the grass birds and other finches are perhaps quite as distinctive.

With perhaps the exception, of the persistent and loud-voiced "kiskadee," of an assemblage of the common tyrant shrikes, there is nothing to be heard in town that can fitly be compared with the cries of birds in the forests, where macaws, parrots, bill-birds, bultatas, quow-birds and other cotingas and loud-voiced species, produce a perfectly astonishing depth and variety of sound, that, but for the deadening influence of the forest, would be in the highest degree harsh and discordant.

There is here, in comparison with the northern temperate districts of the Old World, a marked paucity of the birds of song, due to the fact that there are but few representatives of those special groups that furnish the chief singing birds (*Acromyodi*) of the Old World; while in the species of many of those great characteristic groups that comprise the most distinctive of our birds, the essential structure of the vocal organs renders them destitute of the power of song (*Mesomyodi*) though they are capable of giving expression to various cries so loud and unique, as to render them unmatched among their kind.

In the following preliminary account of the most common of our town birds, an attempt has been made to give not only the zoological names of the species, with their alliances, and the special characters by which they may be determined, but also the various local names by which they are known. This, however, is an altogether unsatisfactory feature in their history, since the names are by no means generally known, nor are they, in a variety of cases, at all distinctive of particular birds. Thus such names as grass-birds, canary, kiskadee, chicken-hawk, etc., are, in each case, applied to many totally distinct birds, which, having certain resemblances either in their habitats, colour, cry or habits, are popularly grouped together.

It may very likely be that in describing the ordinary birds of the town, some of the smaller species have been omitted. The difficulty in dealing with these is considerable, since from their size it is not easy to be certain of the species when they are seen among the trees, and the difficulty of procuring them among the gardens of the city is one that, under the conditions of the case, can scarcely be met. In a good many cases, too, the nesting and eggs of the birds have not been observed; but in the preceding paper by Mr. Lloyd Price much of this information will be found relating to the commoner kinds.

In enumerating the various forms, some simple character, such as colour, might be used more easily to help fix the identity of any given individual, but with its simplicity, there would be the serious drawback of wrenching apart closely allied species; and a plan of relationship will therefore be taken by means of which some general idea as to classification may be attained.

The great group of the Passerine or Perching Birds (*Passeres*) includes the greater number of our town forms, among which the thrushes, wrens, swallows, tanagers, finches, hangnests and tyrant shikes, are some of the commonest of all. The thrushes, of which about a dozen species are to be found in different parts of the colony are represented by three species, two of which (*Turdus phaeopygus* and *T. albiventris*) are extremely common, while the third (*T. fumigatus*) is only occasionally seen. Of the former, the first mentioned or white-throated thrush, which is perhaps the smallest and most widely distributed in the colony, is readily recognised by its dull brown colour above, pale slaty-grey passing into pure white below, and the brown-spotted throat marked by a conspicuous white patch; while in the second, or white-bellied thrush, the upper surface is of a rusty brown, the under parts pale brownish white passing into pure white behind, and the brown-spotted throat destitute of the white patch. In the third or Sabian thrush, the colour is of an ochraceous brown throughout, darker above and lighter below, passing into a white tint in the centre of the body.

The notes of our common thrushes are mellow, full and well-sustained, and on this account the birds are popularly regarded by the resident Europeans as identical with the song thrush of the Old World (*T. musicus*) whose notes, however, are considerably more sustained than in our local species. There is a marked difference, moreover, in the plumage of the song thrush, whose cheeks, throat, breast and flanks are thickly spotted, while in the local forms, the spotting is confined to the throat.

It appears from information that has been derived from various sources, whose trustworthiness I have no reason to doubt, that the song thrush has been introduced into the Colony from England on many different occasions; but certainly it seems not to have flourished, for not a single authentic instance of its occurrence at the present time has been brought to light.

The common town thrushes are to be found, at almost any time, in the Promenade and Botanic Gardens, and in the large private gardens, where they will be seen amongst the foliage or on the ground searching for fruits, seeds and insects. Here they are also frequently heard, though in my own experience never to such advantage as among the trees on the outskirts of the city.

The true thrushes will readily be distinguished from all other birds by the characters of their bill and wings. The former are slender and rather long, wide and depressed, and the latter long and flattened and composed of 10 primary quills. The only birds with which they might be confused are two mocking thrushes, which however are not found about the town, the one, *Mimus gilvus,* a larger bird, being found hitherto only in the high lands of the interior, and the other, *Donacobius atricapillus,* commonly known as fantail, ground powis, and pompadour, being found very commonly among the high grass and low bush, chiefly in swampy districts near the coast. Both of these birds, may, however, be easily distinguished by the form of the wings, which are short and rounded, while the colour in each case is equally distinctive—seen particularly in their tails where the centre feathers are tipped with white, and the others with the white increasing as the outermost feathers are reached.

Throughout the town, in the gardens and in the galleries of the houses, the little warbling wrens are to be heard at all times of the year and at all hours of the day. This little bird (*Troglodytes furvus*) is bout 4 inches in length, of a dull and ruddy brown, with the feathers of the wings and tail closely barred with darker brown, and with the throat, breast and belly dull white passing into a browner colour at the sides. They are fearless little things, jumping about the window-sills, peering into nooks and crannies careless of the presence of man, and enlivening and cheering with their melodious warblings. They build their little nests in all sorts of places—in the galleries, in the bed-rooms, under the house, along ledges, under the eaves, within empty flower pots, inside old pipes, and in other odd situations, often approached by apertures to be passed only by small objects like themselves.

Unfortunately, as a race, they are subjected to the parasitic nesting habits of the Icterine lazy-birds (*Molothrus atro-nitens*), which are often to be seen spying out the homes of the wrens; and the little creatures in finding out places inaccessible to the larger bodied lazy-birds often seem to be all alive to the risks of careless building. When the eggs of the parasite are once deposited, the destruction of the brood of wrens is secured, the lazy-birds hatching sooner than the young wrens and causing their displacement.

The solicitude of the parent wrens for their forced foster-children is almost painful to witness, the large and voracious chicks being at any time but merely excited by the small quantities of food brought, quantities that would be all sufficient for little-bodied wrens. The little foster-parents are thus kept constantly on the move, seeking for moths, spiders and small insects generally, while the appealing cry of the young lazy-bird is a constant incentive to fresh efforts.

Another species of wren, a much larger one (somewhat more than 5 inches in length) is occasionally to be seen, but it is much less common than the white-bellied species. This is the black-faced wren (*Thryothorus* *coraya*), the upper surface of which is of a chestnut colour, with darker wings, and with the tail feathers very distinctly barred, while the cheeks and side face are black, and the under surface of a variable brown tint.

The wrens will readily be distinguished from other birds by their small size, their thin and rather long bills almost destitute of bristles at the gape, their rounded wings, short tail, and strong legs. They are known among the common people by the names "God-bird" and "rain-bird."

The birds now to be mentioned are characterised by having 9 great quill feathers (*primaries*) in the wing, and they are thus known as finch-like birds or fringilliformes, in contra-distinction to the thrush-like birds or turdiformes in which the quills are 10, the first being very short.

Perhaps some of the commonest of our birds are the swallows. Of these there are four species about the city, one or more of which may always be seen flying about overhead or perching on the roofs of the houses and sheds, about the eaves of which they generally make their nests. The commonest is the white-breasted purple swallow (*Progne chalybea*), the whole upper surface of which, in the male, is of a deep purple colour, less so in the female and young birds, passing into grey and white in the under centre.. A larger bird, the purple-breasted swallow (about 7.5 inches in length, the former being about 6.6 inches) in which the purple colour is found above and below (*Progne purpurea*) is also found with the preceding, together with a third species of the same genus, in which the purple tints are replaced by brown (*Progne tapera*).

A much smaller bird, swifter and more bat-like on the wing, is often seen sweeping overhead. This is the red-throated swallow (*Stelgidopteryx ruficollis*). A very curious feature in connexion with these birds is the presence in the males, of a very stiff and roughened outer edge to the first quill of the wing, so that it is distinctly serrated and hard to the touch. They are brown-coloured above, passing into a bright yellow on the under centre, while the throat is of a brick-red.

The swallows are bold and fearless little birds, domineering even over the pugnacious tyrant shrikes or kiskadees. They seem to frequent special houses where by their greater elevation or isolation they are less disturbed; and about these they are found plentifully, chattering and quarrelling with special emphasis at nesting time. They are always to be met with in the river, and generally before heavy rain they are to be seen circling overhead in considerable numbers in the gloomy sky.

The swallows will be easily recognised by their broad, short and thickened bills, their long, pointed wings, and weak feet, characters in which they closely agree, as in habits, with the swifts. They are by their structure, however, widely separated from these birds, as will be seen when the latter group is considered in connection with the humming-birds.

Among the trees with dense foliage, and especially fruit-trees such as the mango, the sapodilla and star-apple, the little flower-peckers (*Certhiola chloropyga*) are always to be found. These are tiny little birds, smaller even than the wrens, and allied to the beautiful blue creepers or sugar-birds (*Coereba*) so commonly distributed in the forest districts near the open savannahs. The plumage is by no means brilliant, being of a dull ashy-black above, black on the head with a white eye-streak, and yellow on the rump, with a prevailing yellow below, the throat however being grey. The bill is rather long, curved, slender and sharp-pointed.

These little birds are often to be seen hunting for insects among the flowers, and jumping about among the branches of the trees, or feeding on the ripe fruits. Their note is a sharp *tweet, pi-pit-tweet, pi-pit-tweet*, and on this account they are commonly known as "pipitoorie," though the same name is also applied to a totally distinct bird, a diminutive tyrant-shrike (*Todirstrum cinereum,*) of much the same size, colour and habits, and almost as common as this little sugar-bird.

Another of this same group of sugar-birds is sometimes to be seen among the trees on the outskirts of the town. This is the blue creeper (*Dacnis cayana*), whose habits closely resemble those of the preceding bird. It will be recognised by its light but bright blue colour in the males, the upper part of the neck, the wings, tail and gorget being black; while in the females the colour is of a bright green, the head being blue. The bill in these birds, for the family, is rather short and thickened, and is sharply pointed.

The family of American creepers, otherwise called sugar-birds and flower-peckers, though similar in their habits to the Old World or true creepers (*Certhidae*), are very different in appearance, due chiefly to the absence of the spiny tail. Some of the most beautiful of birds are forms of this group. In many characters they closely resemble the American warblers, from which however, they differ in possessing a fissured or pencilled tongue. They agree with these, however, in being fringilliformes, that is, destitute of the first shortened quill, while the Old World representatives of both groups are turdiformes.

One of the commonest city birds is a typical representative of the American warblers. This is the yellow summer bird of the United States (*Dendroeca aestiva*), known also as the golden warbler, and locally called canary. They are migrants in the United States, but certain it is that they are to be found about Georgetown all the year round, among the low bushes and high trees. Here they are shy birds, and are with difficulty snared by those who make a practice of caging the song birds.

They are about 4 inches in length, and will easily be recognised by the bright yellow colour above and below in the males, inclining to orange on the head, and with a slight rusty-red tinge on the crown, and with deep rusty-red stripes down the breast and belly, while the wings and tail are brownish with yellow edgings. In the females, the yellow is paler, and a greenish tinge colours it above, while the red stripes are only indicated on the belly. The bill is rather long and thin, and rather wide and depressed.

Among some of the commonest of the town birds, and at the same time one of the most beautiful, is the Tanagrine bird, commonly known to colonists as the cashew sackie (*Rhamphocoelus jacapa*). This bird is known under various common names in different parts of the colony, such as wasoo, buck-town sackie, silver-beak, red sackie, etc., while it has been referred to by black creoles as "white-bill black-bird with a wine breast" It may be taken as a type of the large family of the *Tanagridae*, whose more than three hundred species are entirely confined to the New World, and almost entirely to the tropical parts, where they form some of the most beautiful natural objects to be met with. The members of this family are distinguished from the other singing birds with nine primary quills by the presence of a distinct notch on the upper mandible of the bill, whose form closely approaches that of the true finches, while in many other characters they approach the sugar-birds already described.

This red-breasted tanager is, in the adult male, of a shiny black above with crimson reflections, while the head and neck are of a deep red and the breast of a bright wine red. The under beak is of a pale silvery white, and thickened. They are rather more than six inches in length. The female is of a dull rusty red throughout. They are to be seen in all parts of the town flitting about among the trees, on the fruit and seeds of which they almost entirely subsist. Their note is sharp and shrill and by no means pleasing, with a recurring sound of "sick" nasally pronounced. They are active birds, and are constantly on the move from tree to tree.

Very closely applied to the preceding are the blue tanagers (*Tanagra episcopus*), commonly known as blue sackies, though the name, taken from the note of the bird, can hardly be said to be really imitative of their cry. This bird is of a uniform pale blue colour throughout, with a much shorter and narrower bill than the rather lager cashew sackies. In their habits they very closely resemble that species, though they are considerably more shy, and are seldom to be seen among the house-gardens in the city. About the outskirts of the town, they are fairly numerous, flitting about the various fruit trees and seed-bearing plants.

Another tanager often met with, and very common among the coco-nut palms among which they chiefly make their nests, is the so-called palm sackie (*Tanagra palmarum*). These birds in their habits and diet closely resemble the two preceding species, from which their somewhat greater size, and their coloration, at once readily distinguish them. They are of a nearly uniform ash or pale olive-green colour throughout. Both this bird and the two preceding are frequently snared by boys and kept in cages for sale, though, as song-birds, there is no value to be placed upon them. Among the houses of the native Indians, they are also often to be seen, with their wings trimmed, and wandering at large about the settlement.

Among the shrubs and trees generally throughout the town, a somewhat larger tanager than the preceding, and one which by the size and shape of its bill would commonly be referred to the finches, is always to be met with. This is the tom-pitcher (*Saltator magnus*), whose upper colouring is of an olive-green, the under surface an ashy grey, tinted with yellow, chin white and with a black border on each side. The bill is decidedly thick, swollen and finch-like, but it bears a distinct hook at the tip and is slightly notched.

These birds chiefly frequent the smaller bushes and trees, where they seek out the seeds and fruit. They are also often to be found on the ground. They are restless birds, seldom quite stationary for any length of time, but jumping and jerking about from branch to branch and tree to tree. Their cry is loud and somewhat harsh. They are frequently caught by boys, and though as a rule they thrive fairly well in confinement, they are neither beautiful in plumage, nor melodious in song.

In the plantations on the outskirts of the town, species of the beautiful tiny louis-d'ors (*Euphonia*) are obtainable; but as their occurrence in town is not based on submitted skins nor on my own observation, there can be no guarantee given to the fact. These birds are known by the name canary and bastard canary, and the commonest are referable to the two species of *Euphonia violacea* and *E. plumbea*. They will readily be known by the shining deep blue colour above and orange-yellow below of the first species, and the ashy-blue above and golden-yellow below of the second form. They are both often snared for cages, and at times are thus to be obtained about the streets in considerable numbers. They are sprightly, active little creatures, about 3 inches or more in length, with short, thickened bills, large heads compared with their bodies, and short tails.

Two other common birds often met with, and like the foregoing known as canary, generally grass canary, are, however, referable to the true finches. These are *Sycalis flaveola* and *S. minor*. They will be recognised at once by their short and thick finch-like bills and their yellow colour. The former is a little more than 5 inches in length, of a bright yellow colour in the male inclining to orange in parts of the front, and with darker olive parts to the wings and tail and the middle of the feathers generally; while in the females, the greener and darker tints predominate on the upper surface, passing into a pale whitish yellow below.

In the second species, which is a much smaller bird (about 4½ inches), the colour is much darker and duller above, the yellow being washed with green and brown in the male, and considerably more so in the female, while the yellow of the under side is clear and bright, but inclining to whitish brown in the females. In the young birds the colours are duller.

These pretty little birds are often to be seen flying about the bushes and trees in the town, and are commonly found on the high grass stems in open places. They are great favourites as cage birds, and are often to be seen, in the common pith-cages, being hawked about the street.

Closely allied to the preceding are several little finches from three to four inches in length, which as a rule frequent the grassy and bushy wastes, seeking for grain and seeds, and hence are called by the common name, grass-birds, though they are often seen among the trees and upon the ground. They are nearly all referable to the genus *Spermophila*, and will readily be distinguished from the grass canaries by the greater stoutness of the bills, the under mandible being especially enlarged at the base.

In one very common species, *S. minuta*, the entire under surface in the male is of a chestnut colour, while the upper surface is brown, with a slight greenish tinge, except the hinder part of the back which is of a rich chestnut. Some whitish ashy spots are found on the front and tip of the wings. In the females the chestnut is absent, the prevailing colour being brown with traces of a greenish tinge, and pale yellowish and ashy brown below. The young birds are like the adult females, though, traces of the chestnut of the adult males soon begin to appear.

In another equally common species, *S. lineata*, the prevailing colour above is bright greenish black in the males, pale behind and somewhat mottled. The feathers of the wings are edged with white, very conspicuous on the middle of the wing. The cheeks and sides of neck and under surface are white, ashy at the sides of the body, and with a band of black across the neck. The females are greenish brown above, and whitish or yellowish grey-brown below.

Several other species of this large and common genus will be met with, such as *S. lineola* in which the colour above is a greenish black, with a white band on the crown, cheeks and rump, while the throat is black and the abdomen white; and *S. castaneiventris*, blue-grey above, with black wings and tail edged with blue-grey, and with chestnut-coloured throat, breast and abdomen.

As will have been noticed from the foregoing descriptions, the adult males have a very characteristic colouring, by means of which the species will easily be recognised; while the females have a very general similarity in appearance, though the sizes vary a good deal in the different species. As is the case in very many birds, the young males are like the females, though at an early age, they begin to assume their distinctive several characters.

Closely allied to the preceding, but distinguishable at once by their greatly thickened and swollen conical bills and by their greater size, are two species of *Oryzoborus*, known as well by the name grass-bird as by their special names of twa-twa and twa-twa slave. The twa-twa (*O. crassirostris*) is about 5 inches or more in length, and of a glossy black throughout the plumage of the male, with the exception of the auxillary feathers of the wing which are white. The bill is swollen like that of a typical hawfinch or grosbeak, and of a pale yellowish white. The females are olive brown above, and yellowish brown below.

The twa-twa is much prized as a cage bird, and about town they fetch high prices—their whistling and chirping being very sweet and rich. They are frequently seen on the outskirts of the city among the grass and low bush of the open lands, where they feed on various seeds and kind.

In bushy outlying places where the foregoing bird occurs, there will always be found the second but smaller species of the same genus, known as the twa-twa slave (*O. torridus*), which however is much more common in and around the city than the twa-twa. With the exception of some white spots at the base of the quills of the wings, and the chestnut of the breast and abdomen, the plumage is of a glossy black in the male; while the female is dark greenish brown above with a reddish tinge on the hind back, tail and wings, and of a pale reddish brown beneath. In habits this bird closely resembles the preceding finches.

At the back of the Botanic Gardens, along the Lamaha Canal, on the outskirts of the town, the black bunyah (*Ostinops decumanus*) will occasionally be met with. This is a large black bird, with chesnut-coloured rump, and yellow tail, with the two central feathers black.. The bill is pale yellowish white and very large, nearly straight and pointed, and with the upper part expanded into a large shield which is continued on to the forehead. It may be taken as a typical member of the hangnests or Icterine family, its nest being several feet in length and purse-shaped, suspended from the ends of branches, generally near or over water. The more than 100 members of this group of birds are all confined to America, where they take the place of the starlings. They are known by various names, such as cassiques, hangnests, troupials, orioles, etc., and many of them are gifted with great powers of song, while others are imitative to a remarkable degree, such as the common mocking-bird of Guiana (*Cassicus persicus*) which does not occur within the immediate neighbourhood of the city.

In all parts of the town, the common yellow hang-nest or plantain bird (*Icterus xanthornus*) will be found flying about among the trees, and their long purse-shaped nests are often to be met with on the outskirts. These are handsome birds, about 7 inches in length, of a bright yellow colour, with a greenish tinge between the black wings, which are distinctly marked with white; the tail and the middle of the throat are also black. The females and young males are much greener and duller in colour. They are often caged on account of the brilliancy of their plumage, though they are much less brilliant than another species, the troupial (*I. croconotus*), common in the interior and much prized as a cage bird both for plumage and song.

Another very common member of this group is the parasitic lazy-bird (*Molothrus atro-nitens*), whose cuckoo-like habits have already been referred to in connection with the commonest of their small victims. This bird is about 7 inches in length, of a deep shining purplish black in the adult males, and brown in the female and young males. They are more commonly found on the outskirts of the town, where the wrens suffer from their loose habits much more than in the town proper. These birds do not make nests of their own, but deposit their eggs in the nests of smaller birds. It is a curious feature in their Natural History that the parasitic habits of the Old World cuckoos should be found characteristic of this genus of birds while the American cuckoos have normal nesting habits.

In swampy places on the outskirts of the town, but chiefly along the coast, the common small yellow-headed reed-bird (*Xanthosomus icterocephalus*) will generally be found in considerable numbers among the low bush and tall reeds and grasses. The males are, with the exception of the yellow neck and head, of a black colour throughout, while the young males and females are blackish and yellowish brown.

Closely related to the preceding are the so-called robin red-breasts (*Leistes guianensis*), which are found about the outer parts of the town, chiefly in grassy and bushy open places. The adult males are blackish brown, with a rich scarlet throat breast and belly, while the young male and the females are much paler, and with much less scarlet below.

The so-called black-birds (*Quiscalus lugubris*), which are so often to be seen in large flocks in the roads and the open grassy spaces around the town, are also members of the Icterine group, though unlike the typical species, they do not make pendent but flat nests—a character in which they resemble the preceding form. The adult males are about 8 inches in length, and of a bright black throughout, with violet reflections. The females are somewhat smaller and of a duller, browner black. They feed largely on grains, seeds and insects.

So far the species which have been under notice are members of the acromyodian group of the perching birds, that is, those which from the structure of their vocal organs are known as the singing birds. The remaining mesomyodian perchers, the songless birds, now call for notice. Of these but three families are represented in Georgetown, two each by one species, while the third that of the tyrant shrikes, comprises many of the commonest of the strictly town perchers.

The family of the tyrant-birds (*Tyrannidae*) includes in all more than 400 species, and is restricted to the New World where they represent the flycatchers of the Old World. They have wide and depressed incurved bills, hooked or notched at the tip, and abundantly provided with bristles at the base, and their coloration is generally of some shade of green and yellow. One of the most typical, and the commonest about town, is the large kiskadee (*Pitangus sulphuratus*) about 8 inches in length, whose loud, harsh and fierce cry of kis-kis-kiskadee is to be heard at all times of the day and all over the city, though very often they give utterance to a more subdued note like a nasal "tweek."

The prevailing colour of the upper surface is brown, the wings and tail being margined with rusty red, while the feathers of the head are black, covering a black-tipped yellow crest of erectile feathers in the males, and surrounded by a white ring; beneath sulphur-yellow predominates, the throat being white. It is a fierce and cruel bird, having special fondness for the young of other birds as food, taking them from the nest when chance offers. Their diet is a liberal one, since they feed on flesh, fruits, seeds, worms, insects, etc.; and while on the one hand they are of use in gardens as insectivorous creatures, on the other they are nuisances as being equally destructive to fruits. Of grapes and peppers they are extremely fond and they will often be noticed swallowing large quantities of the fruits. They are markedly quarrelsome and pugnacious, and will never hesitate in attacking and driving away larger birds such as the vultures and hawks, which they often seem to delight in pursuing. The swallows and humming-birds, however, often attack and pursue them, and occasionally when the kiskadees are darting and pecking at a hawk or vulture, a humming-bird may be seen pursuing the tyrant and driving him off.

The name kiskadie is applied to several different species, all of which utter the same cry; but the above large form is the commonest of all about the town. A smaller bird (*Pitangus lictor*) is also very common, and is chiefly distinguishable from the larger bird by its size (about 6½ inches in length) and by the rather greener brown of its plumage. The bill too is much thinner and narrower. Its habits are similar to the larger species.

A third kiskadie (*Megarhynchus pitangua*) is also often met with, commonly among the tamarind trees. This is the largest of all, being about 8½ inches in length. Its colours agree in every respect with those of the common *P. sulphuratus*, but the crest feathers are orange or orange-yellow. It is readily known by its enormously widened and flattened bill, which tends to be almost shovel-shaped.

The cry of this bird is harsher and deeper than the common species, but not so loud and piercing. It is altogether a less fierce and pugnacious bird, and will often be seen perched in the same attitude for long periods.

A fourth kiskadie (*Tyrannus melancholicus*) much about the same size as the commonest species, is also very plentiful about the city. It differs from the others in having the upper surface brownish or greenish grey, with a concealed crest of scarlet and yellow on the top of the head, but with no white ring. The wings and tail are blackish, the former being long and the latter deeply forked; the throat and fore-breast grey or greyish white, and the hind breast and abdomen yellow. This bird is much more active than the preceding form, and is stronger on the wing than *P. sulphuratus* owing to its longer pinions. It is, however, much less lively, noisy and quarrelsome than this common form.

A fifth form of kiskadie (*Myiozetetes cayennensis*) is also fairly common about the city, though chiefly seen on the outlying parts. This is a much smaller bird than any of the others, being about 5½ inches in length, and commonly known as small kiskadie. The markings are almost exactly those of *P. sulphuratus*, except that there is much more of the rusty-red tint on the edges of the wing feathers, which are also a blacker brown. The bill, however, is much shorter, thinner and altogether less strong in proportion.

Among some of the commonest of the birds seen about the streets and gardens of the town are various species of greyish tyrant-birds, with rather small flattened bills, commonly known as muff-birds. These are species of the genus *Elainea*, the several forms of which very closely resemble each other. The two commonest are *E. pagana* and *E. albiceps*, each about 6 inches in length, with a crest of concealed white feathers, which they often erect, and with white edges to the feathers of the wings so as to form cross bands. The first species is somewhat greyer above than the second, with the belly much more yellowish in tinge.

These birds feed on seeds and insects, but particularly the latter: and when they have secured some tit-bit are often to be seen chased by the kiskadees and compelled to drop the treasure. At such times they erect their crests to great advantage as though with a desire to fight, but they have neither strength nor courage to face their tyrants.

Among the large trees with dense foliage, as well as the flowering shrubs which the little flower-peckers (*Certhiola*) frequent, will also be often seen the little broad-billed tyrant-bird, known as pipitoorie (*Todirostrum cinereum*).. These tiny birds are about 3½ inches in length, ashy above, with black crown, black wings edged with yellow and white, and black tail edged with white, and yellow throughout the under surface. The bills are very long, broad and flattened.

A very common small tyrant, about 4-5 inches in length, known as cotton-bird (*Fluvicola pica*), is also usually to be found about the grassy parts of the town, and more especially by the trenches of the outskirts among grassy and bushy wastes. With the exception of the back of the head, the middle back, the wings and tail, which are black, the rest of the bird is a pure white.

These pretty but sober-coloured little birds feed chiefly on worms and insects which they seek among the grass and low bush and on the ground. They are not at all shy, but will allow of one's close approach.

In similar places to the preceeding on the outskirts of the town will be found another small tyrant, somewhat smaller than the cotton-bird and known as the parson-bird (Arundinicola leucocephala). With the exception of the head and neck which are white, the rest of this bird is of a deep shiny black in the male, while in the female it is of a prevailing ash-colour, except the head and sides of face and the under surface which are whitish, while the tail is black. These birds, like the fore going, frequent the neighbourhood of water, perching on the small twigs and stems, but chiefly on the reeds and reed-like growths. Almost invariably they will be seen in pairs, darting from bush to bush in search of insects. The common name is evidently taken from the resemblance of its colour to those of a parson and his gown. —Timehri Journal, Vol V.

(*To be Continued.*)

PRESENT-DAY PROBLEMS IN CROP PRODUCTION.

SIR E. JOHN RUSSELL, F.R.S.

COMPLEXITY OF THE PROBLEM.

The Agricultural investigator is confronted with three closely interlocking agencies—the plant, the climate, and the soil—each of which is variable within certain limits, and each playing a large part in the crop production which it is his business to study.

Confronted with a problem of this degree of complexity there are two methods of procedure: the empirical method of field observations and experiments, in which there is no pretence of great refinement and no expectation that the same result will ever be obtained twice, it being sufficient if over an average of numerous trials a result is obtained more often than would be exposed from the laws of chance; and the scientific method, in which the factors are carefully analysed and their effects studied quantitatively; a synthesis is then attempted, and efforts are made to reconstruct the whole chain of processes and result. The scientific method is, of course, the one to which we are naturally attracted. But common truthfulness compels one to admit that up to the present the greatest advances in the actual production of crops have been effected by the empirical method, and not infrequently by men who are really artist rather than men of science, in that they are guided by some intuitive process which they cannot explain, and that they have the vision of the result before they obtain it, which the scientific man commonly has not.

The best hope for the future lies in the combination of the empirical and the scientific methods. This is steadily being accomplished by the recent strong infusion of science into the art of field experimentation, which has much enhanced the value of field work and the trustworthiness of its results. Modern methods of replication such as have been worked out at Rothamsted, and in the United States by Harris of the Carnegie Trust (Cold Spring Harbour) Kiesselbach in Nebraska, Myers and Love of Cornell, and others, constituted a marked inprovement in plot technique. The figures themselves, besides being more accurate, can be made to yield more information than was formerly the case.

Great advances have been made in the methods of analysing the results. The figures are never the same in any two seasons, since the climatic conditions profoundly effect the yields. A few men like J. H. Gilbert, have the faculty of extracting a great deal of information from a vast table of figures, but in the main even the trained scientific worker can make very little of them. The reason is that he has been brought up to deal with cases where only one factor is varying, while the growth of plants involves the interaction of three variable factors: the plant, the soil and the climate. It is impossible to apply in the field the ordinary methods of the scientific investigator where single factors alone are studied; very different methods are needed, adapted to the case where several factors vary simultaneously.

Fortunately for agricultural science, statisticians have in recent years worked out methods of this kind, and these are being modified and developed by R. A. Fisher and Miss Mackenzie for application to the Rothamsted field data. It so happens that this material is very suitable for the purpose, since a large number of field experiments have been repeated every year for seventy or eighty years on the same crop and on the same piece of land, using the same methods; the field workers also remain the same for many years, the changes being rare and without break in continuity. Although the statistical investigation is only recently begun, mathematical expression has already been given to the relationship between rainfall and yield of wheat and barley under different fertiliser treatment, and precision has been given to some of the ideas that have hitherto been only general impressions. If on an average of years a farmer is liable to a certain distribution of rainfall, it is becoming possible to advise as to fertiliser treatment which enables the plant to make the best of this rainfall.

ALTERNATIONS IN THE PLANT.

It is a common place among farmers that certain soil conditions influence not only the yield but also the quality of crops. The leaf and root are more easily affected than the seed. The case of mangolds has been investigated at Rothamsted; the sugar content of the root, an important factor in determinating feeding value, was increased by increasing the supply of potassium to the crops. Middleton at Cockle Park showed that grass increased in feeding value—quite apart from any increase in quantity—when treated with phosphates. Potatoes are considerably influenced by manuring; increasing the supply of potassium influences the composition of the tubers and also that more impalpable quality—the cook's estimate of the value of the potato; while we have found at Rothamsted that a high-class cook discriminated between potatoes fertilised with sulphate of potash and those fertilised with muriate of potash, giving preference to the former.

Grain is more difficult to alter by changes in environmental conditions; indeed, it appears that the plant tends to produce seed of substantially the same composition whatever its treatment—with the important exception of variation in moisture supply. Mr. Shutt has explored the possibilities of altering the character of the wheat grain by varying the soil conditions, and finds that increases in soil moisture decrease the nitrogen in the grain. Similar results have been obtained in the United States.

On the other hand, in England the reverse seems to hold, at any rate for barley. This crop is being fully investigated at the present time under the research scheme of the Institute of Brewing, because of its importance in the preparation of what is still Britain's national beverage. Increased moisture supply increases the percentage of nitrogen in the grain, and so also does increased nitrogen supply, though to a much less extent; on the other hand, both potassic and phosphatic fertilisers may decrease the percentage of nitrogen, though they do not always do so; the laws regulating their action are unknown to us.

The practical importance of these problems of regulating the composition of the plant lies in the fact that the farmer can control his fertiliser supply, and also to some extent his moisture supply, so that it lies within his power to effect some change should he wish to do so.

In agricultural science one sometimes thinks only of the crop and the factors that affect its growth. But in agricultural practice there is often another partner in the concern: a pest or parasite-causing disease. The amount of damage done by pests and diseases to agricultural crops is astounding; in Britain it is probably at least 10 per cent. of the total value of the crops and the loss is probably some 12,000,000 l. sterling per annum; in some countries it is considerably more. Indeed, the number of insect pests and of harmful fungi and bacteria that skilled entomologists and mycologists have found in our fields might almost lead us to despair of ever raising a single crop, but fortunately the young plant, like the human child grows up in spite of the vast number of possible deaths. The saving fact seems to be that the pest does harm only when three sets of conditions happen to occur together; the pest must be present in the attacking state, the plant must be in a sufficiently receptive state; and the conditions must be favourable to the development of the pest. It is because this favourable conjunction of conditions comes but rarely that crops manage to survive; and this gives us the key to control if only we knew how to use it. Complete control of any of these three conditions would end all plant diseases. Unfortunately, control is never complete even in glass-house culture, still less out of doors. But even partial control would be very helpful. All these pests go through life cycles, which are being studied in great detail all over the world, and especially in the United States. Somewhere there occurs a stage which is weaker or more easily controlled than others, and the pest would become harmless if the chain could be broken here or if the cycle could be sufficiently retarded to give the plant a chance of passing the susceptible stage before it is attacked.

The plants themselves, as we have just seen, are in some degree under control, and if they could be pushed through the susceptible stages before the pest was ready, they would escape attack. Barley in England is sometimes considerably injured by the gout fly. (*Chlorops taeniopus*). The larvae emerge in spring from the eggs laid on the leaves and invariably crawl downwards, entering the young ear if, as usually happens, it still remains ensheathed in leaves. J. G. H. Frew, at Rothamsted, has shown that early sowing and suitable manuring cause the ear to grow quickly above the track of the larvæ, and thus to escape injury. E. A. Andrews, in India, has found that tea-bushes well supplied with potassic fertiliser escape attack from the mosquito bug (Helopeltis) for the rest of the season, apparently because bushes so treated become unsuitable as food to the pest. Further, the conditions are alterable. H. H. King, in the Sudan, has effected some degree of control of the cotton thrips (*Heliothrips indicus*) by giving the plant protection against the drying north wind and so maintaining a rather more humid atmosphere—a condition in which the plant flourishes more than the pest. Tomatoes in England suffered greatly from Verticillium wilt until it was found that a small alteration of temperature threw the attack out of joint. They are also much affected by stripe disease (*B. Lathyri,*) but they become more resistant when the supply of potash is increased relative to the nitrogen. It has recently been maintained, though the proof is not yet sufficient, that an altered method of cultivating wheat in England will afford a good protection against bunt. These cultural methods of dealing with plant diseases and pests offer great possibilities, and a close study jointly by plant physiologists and pathologists of the responses of the plant to its surroundings, and the relationship between the physiological conditions of the plant and the attack of its various parasites, would undoubtedly yield results of great value for the control of plant diseases. Again however, the plant breeder can save a world of trouble by producing a variety resistant to the disease; or there may fortunately be found an immune plant from which stocks can be had, as in the case of the potatoes found by Mr. Gough to be immune to the terrible wart disease.

CONTROL OF ENVIRONMENTAL FACTORS.

It thus appears that, if only plant breeders and plant physiologists could learn to alter existing plants or to build up new plants in such a way that they should be well adapted to existing soil and climatic conditions, and not adapted to receive disease organisms at the time the organisms are ready to come—if only they could do this, all agricultural land would become fertile and plant diseases and pests would become ineffective: at any rate until the pests adapted themselves to the new plants. Although no one can set limits to the possibilities of plant breeding and plant physiology, we cannot assume that we are anywhere near this desirable achievement or that we are likely to be in our time.

There will always remain the necessity for altering the environmental conditions to bring them closer to the optimum conditions for the growth of the plant. No attempt is yet made in the field to control two of the most important of the factors: the light and the temperature, though it is being tried experimentally. There is a great field for future workers here; at present plants utilise only a fraction of the radiant energy they receive. At Rothamsted attempts have been made by F. G. Gregory to measure this fraction; the difficulties are considerable, but the evidence shows that our most efficient plants lag far behind our worst motorcars when regarded as energy transformers for human purposes. One hundred years ago the efficiency of an engine as a transformer of energy was about 2 per cent.; now, as a result of scientific developments, it is more than 30 per cent. To-day the efficiency of the best field crops in England as transformers of the sun's energy is about 1 per cent.: *can we hope for a similar development in the next hundred years? If such an increase could be obtained an ordinary crop of wheat would be about 400 bushels per acre and farmers would feel sorry for themselves if they obtained only 200 bushels. But we are only at the beginning of the subject. Increases in plant growth amounting to some 20 or 25 per cent. have been obtained by V. H. Blackman in England under the influence of the high-tension electric discharge, which persumably acts by increasing in some way the efficiency of the plant as an energy transformer. Possibly other ways could be found. It needs only a small change in efficiency to produce a large increase in yield. Much could be learned from a study of the mass of data which could be accumulated if agricultural investigators would express their results in energy units as well as in crop yields as at present.

Interesting results may be expected from the attempts now being made in glass-house culture both in Germany and at Chestnut to increase the rate of plant growth by increasing the concentration of the carbon dioxide in the atmosphere.

CONTROL OF THE SOIL FACTORS.

The soil factors lend themselves more readily to control and much has been already achieved. Water supply was one of the first to be dealt with. Civilisation arose in the dry regions of the earth, and so far back as 5,000 years ago, irrigation was so advanced as a practical method that it came into the ordinances drawn up by the great Babylonian king Hammurabi. The chief problems at the present time are to discover effective means of economising water and to ascertain, and if possible control, the relationships between the soil, the water, and the dissolved substances in the water.

Inseparably bound up with water supply are the questions of cultivation and of drainage, which affect not only the water but the air supply to the roots. The former subject is now attracting considerable attention: the great need is to discover means for expressing cultivation in exact physical and engineering units. The measurements of Keen and Haines at Rothamsted and the chemical work of A. F. Joseph, N. Comber, and others on clay, and of Oden, Page, and others on humus, indicate the possibility of finding exact expressions and of effecting co-operation with the workers in the new fields of agricultural engineering.

Another soil factor which readily lends itself to some degree of control is the amount of plant nutrients present. The possibility of increasing this by means of manure has been so frequently explored in field trials that it has sometimes been regarded as almost a completed story; indeed, Rothamsted tradition affirms that Lawes himself once gave orders to have the Broadbalk field experiments discontinued because they had nothing further to tell; it was only the earnest pursuasion of Gilbert that caused him to countermand the order. So far from the subject being exhausted it still bristles with problems. The new nitrogenous fertilisers, resulting from War-time activities in nitrogen fixation; the need for reducing the cost of superphosphate; the change in character of basic slag; and the Alsatian development in potash production, are producing changes in the fertiliser industry the full effects of which are not easy to foresee. Economic pressure is driving the farmer to derive the maximum benefit from his expenditure on fertilisers, lime, farmyard manure, and other ameliorating agents, and is compelling a more careful study of possibilities hitherto disregarded, such as the use of magnesium salts, silicates, and sulphur as fertilisers, and, above all, a much more precise diagnosis of soil deficiences than was thought necessary in pre-War-days.

There are, however, more fundamental problems awaiting solution. It is by no means certain that we know even yet all the plant nutrients. The list complied by Sachs many years ago includes all needed in relatively large amounts, but Gabriel Bertrand has shown that it is not complete and that certain substances—he studied especially manganese—are essential, although only in very small amounts. Miss Katherine Warington working with Dr. Brenchley at Rothamsted, has shown that leguminous plants fail to develop in the so-called complete culture solution unless a trace of boric acid is added. Maze has indicated other elements needed in small amounts.

Another problem needing elucidation is the relationship between the quantity of nutrients supplied and the amount of dry matter produced. Is dry matter production simply proportional to nutrient supply as Liebig argued, with the tailing off beyond a certain point, as demonstrated by Lawes and Gilbert, or is it always less than this as indicated by Mitscherlich's logarithmic curve; or is the relationship expressed by one of the more complex sigmoid curves as there is some reason to suppose? We do not know; and the problem is by no means simple, yet it governs the "diminishing returns" about which farmers now hear so much.

Again, very little is known of the relationship between nutrition and the period of growth of a plant. One and the same quantity of a nitrogenous fertiliser, for example, may have very different effects on the plant according as it is given early or late in life; not only is there a difference in quantity of growth, but also in the character of the growth. Late dressings cause the characteristic dark-green colour to appear late in the season, and thus affect the liability to fungoid diseases; they increase the percentage of nitrogen in the grain and they may give larger increases of crop than early dressings.

Investigations are needed to find the best methods of increasing the supply of organic matter in the soil and its value for the different crops in the rotation.

All these problems will sooner or later find some solution. But there remains a greater problem of more importance than any of them : the linking up of plant nutrition studies with those of the soil solution. As our cousins in the United States were the first to emphasise, the fundamental agent in the nutrition of the plant is the soil solution, and they have made a remarkable series of investigations into what appeared at one time a hopeless proposition—the physico-chemical interactions between the soil and the soil water. A great advance in crop production may be expected when the soil chemists have discovered the laws governing the solution, when the plant physiologists can give definite expression to the plant's response to nutrients, and when some one is able to put these results together and show how to alter the soil solution so that it may produce the maximum effect on the plant at the particular time. The new soil chemistry will yet have its triumphs.

THE SOIL MICRO-ORGANISMS.

It is now more than forty years since the discovery of the great importance of micro-organisms in determining soil fertility. Practical applications necessarily lag far behind; but already three have been made each of which opens out great possibilities for the future. The long-standing problem of inoculation of leguminous crops with their appropriate organisms has already been solved in one or two of its simple cases, chiefly lucerne on new land, and the new process has helped in the remarkable extension of the lucerne crop in the United States and in Denmark. We believe at Rothamsted that the more difficult English problem is now solved also. Interesting possibilities are opened up by the observation that a preliminary crop of Bokhara clover seems to facilitate the growth of the lucerne.

The organisms effecting decomposition are now coming under control and are being made to convert straw into farmyard manure (or a material very much like it) without the use of a single farm animal. The process was worked out at Rothamsted, and is being developed by the Adco Syndicate, which is now opera-ing it on a large scale and is already converting some housands of tons of straw annually into good manure.

The third direction in which control of the soil organisms is being attempted is by partial sterilisation. This process is much used in the glass-house in England, and it has led to considerable increases in crop yields. The older method was to use heat as the partial sterilising agent, and this still remains the most effective, but owing to its costliness efforts have been made to replace it by chemicals. Considerable success has been attained; we have now found a number of substances which seem promising. Some of these are by-products of coal industries; others, such as chlor-and nitro-derivatives of benzene or cresol, are producible as crude intermediates in the dye industry.

THE NEED FOR FULLER CO-OPERATION.

Looking back over the list of problems it will be seen that they are all too complex to be completely solved by any single worker. Problems of crop production need the co-operation of agriculturists, plant physiologists, soil investigators, and statisticians. Even plant breeding necessitates the help of a physiologist who can specify just what the breeder should aim at producing. This gives the keynote to the period of agricultural science on which we have now entered—it is becoming more and more a period of co-operation between men viewing the problem from different points of view. Good individual work will of course always continue to be done, but the future will undoubtedly see a great expansion of team work such as we know from our experience at Rothamsted is capable of giving admirable results in agricultural science.

With fuller co-operation both of men and of institutions we could do much to overcome the present difficulty in regard to utilising the information we already possess. In the last thirty years an immense stock of knowledge has been obtained as to soils and crops. It is stored in great numbers of volumes which line the shelves of our libraries, and there much of it rests undisturbed in dignified oblivion. In the main it consists of single threads followed out more or less carefully; only rarely does some more gifted worker show something of the great pattern which the threads compose. But even the most gifted can see but little of the design; the best hope of seeing more is to induce people to work in groups of two or three, each trained in a different school and therefore looking at the problem from a different point; each seeing something hidden from the rest. Unlike art, science lends itself to this kind of team work; art is purely an individual interpretation of Nature while science aims at a faithful description of Nature, all humanistic interpretation being eliminated. There is certainly sufficient good will among the leaders of agricultural science to justify the hope of co-operation; there are probably in existence foundations which would furnish the financial aid.

This leads to my last point. What is the purpose of it all? Team work, co-operation, the great expenditure of time and money now being incurred in agricultural science and experiment—these are justified only if the end is worthy of the effort. The nineteenth century took the view that agricultural science was justified only in so far as it was useful. That view we now beleive to be too narrow. The practical purpose is of course essential; the station must help the farmer in his daily difficulties—which again necessitates co-operation, this time between the practical grower and the scientific grower. But history has shown that institutions and investigators that tie themselves down to purely practical problems do not get very far; all experience proves that the safest way of making advances, even for purely practical purposes, is to leave the investigator unfettered. Our declared aim at Rothamsted is "to discover the principles underlying the great facts of agriculture and to put the knowledge thus gained into a form in which it can be used by teachers, experts, and farmers for the upraising of country life and the improvement of the standard of farming."

This wider purpose gives the investigator full latitude, and it justifies an investigation whether the results will be immediately useful or not—so long as they are trustworthy. For the upraising of country life necessitates a higher standard of education for the countryman; and education based on the wonderful book of Nature which lies open for all to read if they but could. How many farmers know anything about the remarkable structure of the soil they till, of its fascinating history, of the teeming population of living organisms that dwell in its dark recess; of the wonderful wheel of life in which the plant takes up simple substances and in some mysterious way fashions them into foods for men and animals and packs them with energy drawn out of the sunlight—energy which enables us to move and work, to drive engines, motorcars, and all the other complex agencies of modern civilisation? No one knows much of these things; but if we knew more and could tell it as it deserves to be told, we should have a story that would make the wildest romance of human imagination seem dull by comparison and would dispel for ever the illusion that the country is a dull place to live in. Agricultural science must be judged not only by its material achievements, but also by its success in revealing to the countryman something of the wonder and the mystery of the great open spaces in which he dwells.—*Nature, Vol. 114, No. 2864.*

ATTENDANCES AT THE DISTRICT GARDENS.

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...								
1st Quarter	1,008	1,071	389	646	404	517	436	4,471
2nd Quarter	1,002	723	302	409	344	610	326	3,716
3rd Quarter	1,006	383	129	410	450	504	438	3,320
4th Quarter	1,107	650	283	324	480	515	464	3,823

Meteorological Data 1924.

BOTANIC GARDENS, GEORGETOWN.

192 4.	Rainfall.	Number of Days of Rain.						Evaporation
MONTHS.	Inches.	Under .10 in.	.10 to .50 in.	.50 to 1.00 in.	1.00 to 2.00 in.	Above 2.00 in.	Total Days.	Inches.
January	4.16	6	10	2	...	...	18	5.17
February	2.85	9	7	1	...	...	17	5.40
March	.28	...	1	...	...	...	1	6.91
April	1.69	6	6	...	...	...	12	6.29
May	12.87	6	4	6	2	1	19	5.31
June	15.85	3	11	8	5	...	27	3.35
July	8.36	4	19	1	...	1	25	4.42
August	12·66	5	8	6	2	1	22	3.91
September	6.42	4	5	1	3	...	13	5.52
October	5.19	2	5	1	1	1	10	4.10
November	4.63	7	5	...	1	1	14	4.59
December	11.22	8	11	3	4	...	26	4.08
TOTALS.	86.18	60	92	29	18	5	204	59.05

Stations.	Wettest Day.	Rainfall.	Hottest Day.	Temperature.
Botanic Gardens, Georgetown ...	25th May.	4.61	22nd Nov.	89.0
New Amsterdam Public Gardens...	13th Aug.	3.23	22nd Apl. 2nd Oct.	90.5
Onderneeming Essequibo ...	16th June.	2.46	11th Mar. 17th Aug 6th and 14th Sep.	93.0
Morawhanna N.W.D. ...	9th Dec.	1.28	...	...

AIR TEMPERATURE AND HUMIDITY IN THE SHADE, BOTANIC GARDENS, GEORGETOWN, 1924.

Months.	Air Temperature.			Humidity.
	Maximum.	Minimum.	Mean.	Mean.
January ...	85.1	74.6	79.8	77.4
February ...	85.2	74.4	79.8	76.5
March ...	86.1	76.1	81.1	69.7
April ...	86.3	76.3	81.3	73.2
May ...	85.9	76.1	81.0	78.3
June ...	84.5	75.1	79.8	82.7
July ...	85.8	74.3	80.0	82.9
August ...	86.3	74.1	80.2	82.8
September ...	86.9	75.5	81.2	78.8
October ...	86.0	75.0	80.5	82.5
November ...	87.2	75.0	81.1	80.0
December ...	84.8	74.9	79.8	81.9
Mean ...	85.8	75.1	80.5	78.9

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during 1924.

The corresponding figures for the two previous years and the average for the fifteen years prior to that are added for convenience of comparison.

Product.	*Average 1907-21.*	*1922.*	*1923.*	*1924.*
Sugar, tons ...	100,251	90,570	83,166	85,896
Rum, gallons ..	2,909,036	422,168	420,996	769,308
Molasses, gallons ...	125,612	76,574	65,997	1,160,757
Cattle-food (Molascuit) tons	4,738	1,072	814	1,102
Cacao, cwts. ...	392	1	None	None
Citrate of Lime, cwts.	171	64	None	None
Lime Juice, gals. ...	*10,020	11,156	11,019	9,785
Essential Oil of Limes, gals. ...	346	634	218	396
Coconuts, thousands	1,596	2,130	2,650	1,560
Coconut Oil, gals. ...	20,075	29,390	26,621	21,804
Copra, cwts. ...	1,101	2,090	8,401	16,508
Coffee, cwts. ...	2,416	7,219	4,778	4,581
Kola-nuts, cwts. ...	13	None	None	None
Rice, tons ...	6,591	8,791	3,971	4,470
Ricemeal, tons ...	815	None	None	None
Cattle, head ...	637	604	994	391
Hides, No. ...	5,011	4,617	5,916	8,902
Pigs, No. ...	671	370	455	427
Sheep, head ...	54	108	37	37
Balata, cwts. ...	10,851	8,146	9,164	12,234
Charcoal, bags ...	61,560	52,866	44,295	42,040
Firewood, Wallaba, etc., tons	8,100	8,441	7,674	6,477
Gums, lbs. ...	3,014	1,502	2,588	708
Lumber, cub. ft ...	236,102	168,504	114,062	180,863
Railway sleepers, No.	8,693	16,146	8,916	39,238
Rubber, cwts. ...	74	None	12	35
Shingles, thousands	2,490	1,976	1,374	1,278
Timber, cub. ft. ...	181,227	184,318	152,168	168,454

*Average for six years, 1916-1922 only. No records available prior to 1916.

JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XVIII. APRIL, 1925. No. 2

EDITORIAL NOTES.

The address given by Professor Harland on Cotton in Trininad, reproduced in the present number is of great interest at this time when attention has been again directed towards the possibility of the commercial cultivation of cotton either from the semi-wild cottons, common in many parts of the front lands or of Hybrids with Sea Island Cotton raised from them.

Our experience has been that there is a somewhat wide range of staple among the lints yielded by these acclimatized, now practically indigenous, varieties of cotton.

When the preparatory work of the hoped for cotton industry is being undertaken one of its most important points will be the examination of the lints of the semi-wild trees and according to its indications, the selection of them as parents for both pure strains of so-called native cottons and for hybridization.

This colony is in a position similar to Trinidad as regards insect pests and diseases. If it is not as simple a matter for Trinidad to fight against pests and diseases as it has been in the Leeward and Windward Islands, it will be a far more complex problem here where the rainfall varies from 80 to 100 inches or even higher per annum, and where our cultivations are almost invariably bounded to the south by savannah or by forest covered lands, in which doubtless many of the insect pests injurious to cotton have their habitat.

The benefits which accrue from adequate drainage cannot be disputed and yet it is suprising to find to what an appreciable extent this branch of our agriculture is neglected. There should be little cause for this in view of the constant attention and advice given by the various agricultural instructors in the districts. This can be particularly noticed on several of our coconut estates, to give but one instance, where stunted and poorly developed trees are unable to withstand the ravages of pests partially through lack of proper drainage and suitable manuring.

We hope, therefore, that the lessons to be learnt from the article on Drainage and Crop Production in this issue will be taken to heart by our farmers in general and that they will realize that proper drainage means larger yields and as a natural sequence greater prosperity.

ARSENATED PETROLEUM AS A WOOD PRESERVATIVE.

Results of experimental trials in timber preservation by treatment with a medium petroleum distillate containing a small proportion of an organic arsenical compound give great promise of a cheap and effective substitute for the expensive methods now in use. Timbers treated by the new process proved perfectly resistant to the attacks of terado and limnoria over a period of four years. Timber treated by other well-known methods, such as the Bethall, Burnett and Chard processes, and exposed to the same conditions of attack were considerably damaged. A great feature of the process is that treatment of the timber may be carried out in open tanks and under normal atmospheric conditions. The total cost is stated to be less than one-half that of any other process of anything like equal success.—*W. Lee Tanner, Journ. Ind. and Eng. Chem., February, 1925.*

THE COUNTY OF ESSEQUEBO AGRICULTURAL INDUSTRIAL AND LIVE STOCK EXHIBITION.

By Edgar Beckett, F.L.S.

The Exhibition held exactly 17 years ago, at Onderneeming, was reported upon by the late Mr. J. F. Waby, F.R.H.S., in the Journal of The Board of Agriculture for June, 1908 as falling short of the standard of the Show held at Suddie in 1904, both in quantity and the general quality of the Exhibits.

Mr. Waby characterised this 'Show' as "disappointing apart from the quality; either there were no entries, or the number of Exhibits in the various classes was small . . . . . . There were only two samples of rice, one white and one brown . . . .

. . . .

Handicrafts were few and of no great merit. The needlework was less than usual." Altogether the Show, from the official report appearing in the *Journal,* appears to have been disappointing.

It is with great pleasure that one is able to report that the Exhibition held on March 10th, 1925, on the grounds of St. John's Rectory and in the Schoolroom, was an unqualified success.

The number of exhibits is said to have outnumbered that of any Show ever held in British Guiana, the quality of the very numerous exhibits in each class, was, on the whole, exceptionally good, while that of Class I, "Live Stock," so far as the Cattle was concerned, has never been equalled before.

The Cattle that were produced show that, with care and attention, very fine animals can be bred in this Colony.

The Horses certainly did not call for special mention, being on the whole somewhat poor, but the judges had a hard task to decide where the cattle were concerned. Some very fine donkeys were exhibited, both mares and stallions. The sheep also were good, as was the display of feathered stock.

On the whole this class was excellent, and goes to prove that the efforts being made by the Board of Agriculture to improve the Live Stock of the Colony, are rapidly bearing fruit.

A pure-bred Short-Horn Bull in excellent working condition, and a pure-bred Short Horn Cow, with an imported Stallion Donkey exhibited from the Government Farm at Onderneeming, attracted considerable attention.

One of the features of the Show was the splendid display made by the 'Model' Exhibit staged by the Board of Agriculture. This Exhibit itself could have taken up an hour or two of one's time. Apart from a fine collection of fruit, vegetables, etc., there was a fine exhibit of fibres with the corresponding fibre-producing plants, rice, coffee, cacao, castor seeds, etc., etc. Special mention must be made of a most magnificent bunch of bananas, probably one of the finest bunches ever produced in the Colony. It was grown on the West Coast of Demerara, and being well-displayed by the Board, attracted considerable attention.

Next to the Board of Agriculture's excellent display, must be mentioned that of The Government Industrial School, Onderneeming. Cacao pods and "cured" cacao, liberian, creole (Arabian), and robusta coffees, hevea rubber—showing the flower, the seed, the young plant, the latex and the marketable product, anatto, various fodder grasses, coconuts, bread, khaki suits and caps, officers' uniforms, milled rice, rice flour, corn flour, green limes, concentrated lime juice, raw lime juice, distilled oil of lime, chocolate, bread fruit, bread nut, gave some indication of the various activities of the boys. A special mention must be made of the honey exhibited by the School. It was certainly the best honey the writer has ever seen in the Colony. This Exhibit was handed over for the Wembley Exhibition mention should also be made of the Exhibit of Charcoal, made by the boys—it was a very excellent sample of a product which, from time to time, appears on our Export list.

A novel feature, which though small, is not without interest, was the display of pipe-cleaners and toothpicks fashioned by the boys from the midribs of the coconut palm—they were well made and certainly as pipe cleaners excellent.

The boys are to be congratulated on the very fine Exhibit they put up.

An unusual feature was the Exhibit of the Sophia Experimental Station. A large black board 12 feet x 8 feet, was erected on which diagrams were shewn illustrating the utility of the Rototiller. The preparation of artificial farm-yard manure and the system of covered drains for heavy clay soils as practised in Assam were explained to the farmers by Dr. Whittles and his assistant Mr. Lauchlan. The significance of water percolation was demonstrated by means of experiments on samples taken from surface-drained and under-drained plots.

The District Garden, Suddie, was well-represented. A Model Garden 12 feet x 7 feet attracted the attention of many of the visitors.

The fruits exhibited do not call for special mention; for the time of the year they were not at all bad. The Bananas were good, as were the citrons. It is pleasing to note that Essequebo did very well in this Class taking many first and second prizes.

"Ordinary" would describe the Vegetables, though some of the eddoes and yams were quite good. The Economic section was full of interest. A very fine display of cacao, coffee, ginger, turmeric, curry powder, rice, various meals and flours—plantain, banana, cassava etc.,—was only equalled by the exhibits of jellies, jams, cakes, oils, cassareep, etc., all of which gave the judges of this important section a great deal of hard work.

Attention should be drawn to what would seem to have been somewhat overlooked, namely the very fine samples of dried vegetables, etc., such as dried strips of sweet potatoes, dried plantains and bananas, dried ochroes and other vegetables. The specimens exhibited were such as to make one consider whether some export trade might not be built up in these products.

The Class for Cut Flowers and Plants call no special mention, though the exhibits were interesting and pleasing; the winner of the 1st prize and 2nd prize being thoroughly deserving of both prizes. The Handicraft and Works of Art sections, certainly were a credit to all concerned.

The class comprising Needle-work and Fancy Work is said to have been the best ever seen in the Colony. A pleasing feature was the large number of hats displayed. These for the most part reflected great credit on the workers, and we should like, at future shows, to see this branch of Industry given more encouragement than is usually the case. There is a possibility of a local market being opened up for such articles—one Panama hat made from a *Carludovica* in the North Western District, shows that our girls, given tuition, would not take very long before becoming adepts at this work.

Sugar-cane and its Products were somewhat poorly represented, but it is satisfactory to note that Buxton, Queenstown, Anna Regina and Hampten Court cane farmers showed good canes, the first-named securing a special prize and the last the first prize.

The Governor's special prize for milled rice was won by Mr. Rashbiharri, and the prize offered by Lady Thomson for the best Artisan's shirt, by Mrs. J. W. Gallienne. The Hon. R. E Brassington's prize for ¼ ton of copra was secured by Mr. R. P. Foo.

Pickled Beef and Pickled Pork do not often engage the attention of local farmers, hence we were pleased to see these exhibits on show. The following taken from "Home-made pork making" by A. W. Fulton, published by the Orange Judd Co. of New York and reproduced in this Journal Vol. xi. 1918 is worthy of attention:—

"For salt pork one of the first considerations is a clean barrel, which can be used over and over again after yearly renovation. A good way to clean the barrel is to place about ten gallons of water and a peck of clean wood ashes in the barrel, then throw in well-heated irons, enough to boil the water, cover closely and by adding a hot iron occasionally, keep the mixture boiling a couple of hours. Pour out, wash thoroughly with fresh water, and it will be as sweet as a new barrel. Next cover the bottom of the barrel with coarse salt, cut the pork into strips about 6 inches wide, stand edgewise in the barrel, with the skin next the outside, until the bottom is covered. Cover with a thick coat of salt, so as to hide the pork entirely. Repeat in same manner until the barrel is full, or the pork all in, covering the top thickly with another layer of salt. Let stand three or four days, then put on a heavy flat stone and sufficient cold water to cover the pork. After the water is on, sprinkle one pound best black pepper over all. An inch of salt in the bottom and between each layer and an inch and a half on top will be sufficient to keep the pork without making brine.

When it is desired to pickle pork by pouring brine over the filled barrel, the following method is a favourite. Pack closely in the barrel, first rubbing the salt well into to the exposed ends of bones and sprinkle well between each layer, using no brine until 48 hours after and then let the brine be strong enough to bear an egg. Allow the pork to remain for six weeks".

Sir Graeme Thompson opened the Show and voiced the feeling of every one in lamenting the fact that Sir John Harrison, through indisposition, was unable to be present.

The Exhibits prove conclusively that, if our people really make an effort, they can give a very good account of themselves. Not only were the exhibits, for the most part, of good quality and high standard, but they were carefully and intelligently put up—in fact this care was a marked feature of the Exhibition. It is satisfactory to note that the people of Essequibo exhibited in large numbers and were able to secure a good percentage of the prizes. So good was the show that it was a pity that two days were not taken up by the exhibition.

It is to be hoped that, very shortly, the disgrace of our having to import large quantities of ground provisions from Barbados and other Islands will be a thing belonging to the dead past. The dried vegetables, starches and flours, of which mention has already been made, should receive attention and efforts made to see whether a trade in these commodities might not be established. They were particularly well-prepared, and if results, apart from mere rivalry and speculation, are to be looked for from our shows, we might turn our thoughts in this direction, especially with the improved Drainage of our Coast Lands in view.

Large quantities of ground provisions will soon glut the local market, so that, if a trade outside can be secured, dried ground provisions, meals and flours, may yet help to make our Peasantry thriving and prosperous.

Spasmodic effort is of little avail. It is to be hoped therefore, that these County Shows will be held periodically, and, that, by means of persistent pressure, something of importance may be achieved. The lapse of seventeen years between the last County Show held at Essequebo, and the recent Exhibition speaks for itself.

COTTON IN TRINIDAD.

The following address by Professor S. C. Harland, D.Sc. of the Imperial College of Tropical Agriculture, is reproduced from the Trinidad Guardian.

Professor Harland in the course of his address said:—Cotton at the present time was of very particular interest to all places situated in the tropical zone for the reason that there was a world shortage of cotton which was becoming more and more pronounced every year. Wherever cotton could be grown it was a very safe and very popular crop and it behove them to examine very carefully the question of whether cotton could be grown in Trinidad or not. Those who had lived in the Colony for a long time knew that in the old days—in the early history of Trinidad—cotton used to be grown fairly extensively, in Tobago also, and he believed the island of Manos. They could see the relict of the cotton industry here in the shape of these large semi-wild tree cotton. At this time of the year they could see large trees covered with sheaves of white cotton. He had the curiosity three or four years ago to take some of this cotton from one tree and have it examined at the Shirley Laboratory in Manchester, and found that the cotton was about the best of its class ever seen in Manchester. It was now equal to the superfine Egyptian and was worth at that time something about 2s. 6d. per lb. As a matter of fact, although these tree cotton looked alike, they were different. Every different tree probably contributed a separate variety. However, if they took seeds from any one plant and sowed them, the plants that would come up would be true to the character of the parent, the cotton would be lustrous or otherwise, and the leaves reddish or green as the case may be. Now the explanation as to why this cotton existed in Trinidad in that pure state was relatively simple. When the cotton industry came to an end in Trinidad about 100 years ago, a few cotton plants were persistently grown by people. A man would keep a tree in his back garden for medicinal purposes ; he understood that a decoction was made from the roots. Again cotton was used for stuffing pillows, and in cases of earache. And so they found that these trees were grown in gardens, and every two or three years the trees died or were killed. The seeds from that tree took its place and gave rise to another generation. They knew that if they went on doing that with one select plant they would get a separate type, especially where the tree was far removed from others and there was no chance of cross fertilisation. That was why each variety had its own peculiar character and was bred absolutely true to different commercial properties. People who have gone to the country and have seen cotton trees bearing luxuriant crops think the cotton industry could be easily established here. It was a mistake to draw that conclusion. In the Grenadines they would see ioslated lime trees in gardens bearing large crops and they would come to the conclusion that the lime industry would flourish there. Experience had shewn them that because they had one tree bearing a large crop they could not start an estate.

THE DIFFICULTY EXPLAINED.

As a matter of fact as soon as they cultivated trees in large numbers they increased the insect pest and plant diseases and this very often militated seriously against success. They must not assume that because they saw a large semi-wild cotton tree bearing heartily that cotton would be very good as a commercial crop here.

WHY COTTON HAS FAILED IN TRINIDAD.

He thought they should inquire why cotton used to be grown here, why it was stopped, and why it was not grown now. They could not go back 100 years and get accurate scientific evidence as to why cotton cultivations failed in Trinidad. It seemed however conclusive that it was some serious disease which caused the industry to collapse. When Sea Island cotton was introduced in the Windward and Leeward Islands, they practically saw the history being repeated. In St Vincent, this cotton at first gave good crops, then crops grew less and less until they got below a profitable amount. Fortunately, it was discovered that one particular disease—the internal boll was responsible for the main loss of the crops. Mr. Nowell worked out that disease and saved the cotton industry in St. Vincent (cheers). Mr. Nowell found that the internal boll had those symptoms. The pods looked perfectly healthy on the outside, but when they were cut open, the inside was found all rotten and decayed. He also found that there was some indication on the inside of the pod that the disease was introduced by some insect. There were obvious punctures from the outside and from the site of one of these punctures the infection spread. It was established that if a muslin cage were put over the bolls to keep the cotton stainer away they would get much more clean cotton whereas if the stainer was introduced every boll would be affected. In 1916, some estates in St Vincent, had 95 per cent. of infection and practically the whole crop was destroyed. It was realised that the growing of cotton in St. Vincent depended on how the stainer could be controlled. The story of how the stainer was controlled in St. Vincent was very simple.

INSECT FOOD CROPS REMOVED.

Several people worked on the problem at the same time, agriculturists, entomologists, etc. and finally it was concluded that if the main two food crops of the cotton stainer, i.e. (the silk cotton tree and the John Bull tree) were destroyed, the cotton stainer would not have enough food to live and propagate during the off season and consequently their members would be reduced to such an extent that they would cease to be a serious pest. The first year the campaign was carried out several thousands of large silk cotton trees were cut down and tens of thousnds of John Bull trees. The first year saw an increase of the crops by over 100 per cent. and a reduction in the number of cotton stainers. Estates which had never made a crop before then made excellent crops and began to see financial daylight for the first time in many years. That campaign has been carried on in St. Vincent ever since 1916-17 and they could see from the results that the cotton stainer was no longer a pest to be frightened of. The cotton industry had been saved and in a stronger position now than it ever was. They would recollect that the Imperial Department of Agriculture in 1900-1903 first began work in the West Indies in the endeavour to introduce cotton in every island including Trinidad, Dominica and in British Guiana. In the earlier records of the Society they would see that a committee was appointed to go into the question. The Committee reported that good results were obtained in some places, but they did not think it was a good crop for Trinidad, as it had to face competition with cocoa for labour. People were not used to its cultivation and the Committee added that pests and disease were likely to militate seriously against it. Much water had flowed under the bridge since then, and much study had been devoted to cotton not only in the West Indies but in various parts of the world and they were now in a position more or less definitely to say whether cotton could be grown in Trinidad and exactly what the factors were against it.

FACTORS AGAINST COTTON GROWING.

The internal boll disease caused by the cotton-stainer did exist in Trinidad in a large amount at a certain time. If the cotton industry were established in this colony they would have to face the fact that a possible increase in the number of stainers would take place and that would wipe the industry out. Next they would have to face the fact that control of the wild food plants of the cotton-stainer was by no means so simple in Trinidad as it had been in the Leeward and Windward Island groups. There were extensive areas of tropical forests in this island which doubtless contained food plants of which science might not yet be familiar. There might be trees of the said family as the silk cotton which would provide alternate hosts for the stainer. Secondly they had to consider the soil of Trinidad. He was referring chiefly to soils on which less than 65 inches of rain per annum fell. He did not think cotton could be grown on wetter soils, but there were no climatic drawbacks to the growth of cotton provided pests were kept in check. There were suitable soils at Chaguanas and in the neighbourhood of the Imperial College of Tropical Agriculture, also certain areas in Mayaro. It would be a matter of survey to determine what areas were most suitable.

TYPES OF COTTON.

The Imperial Department of Agriculture and the Trinidad Department of Agriculture had been carrying out experiments as to the types of cotton that could be grown here and their conclusions might be summarised thus. Sea Island Cotton could be grown very successfully provided it was planted at the right time of the year. It should be planted fairly late, so as to allow three months of vegetative growth and the crop should be allowed to mature in the dry season. Egyptian cotton would not do well in Trinidad. It was far too susceptible to attack from the external boll. As soon as it was introduced into a humid climate, it failed to do well. The third type was Upland cotton. This was also known as the ordinary American or bread and cheese cotton. This cotton would grow very well here. It was however liable to leaf spot during the latter stages of the crop. He mentioned that there was not much in the line of fungus which attacked the cotton, but the cotton stainer attacked all varieties of cotton. From the commercial point of view if Trinidad was to grow cotton he did not think there was any type in existence at present which could be said to be the best type. They would have to breed a type to suit this Colony. It was no use bringing American cotton and planting it here and expect it would be grown successfully right away. They were inflicting a hardship on the American plant in bringing it to Trinidad and expecting it to grow well. He thought American cotton from India would do better here than American cotton from America. Sixty years ago during the American Civil War a good deal of American cotton was grown in India but its cultivation was afterwards abandoned. For years afterwards they continued planting American cotton, and a good many trees which stood in the fields were re-selected and grown. The variety of American cotton from India had done very much better at the Imperial College at St. Augustine than the ordinary American cotton. The type of cotton they should grow here should have been one that the spinners would take in any amount—cotton that would be readily saleable. The best type would be something like the superfine Egyptian cotton. He stated that there was no doubt that such cotton could be bred here. They had the material at the Imperial College to do it and they were now making extensive hybridisation experiments. Continuing the lecturer referred to the cotton hybridisation experiments conducted by Mr. Thornton in Tobago a few years ago until wiped out by the cotton stainer. He mentioned that the cotton industry in the Bahamas had been wiped out by the stainer. Referring to the activities of Dr. Mason a former member of the College on cotton growing in Africa, he stated that from recent papers from him he had learnt that a large proportion of the boll had been attacked by the cotton stainer, and the people in Africa could consider the experience of the West Indies before deciding to grow cotton extensively as a crop. The only other pest he thought necessary to refer to was the Trinidad boll worm. It had attacked the cotton trees at the College but it did not give very much trouble as it had here too many animal parasites.

In conclusion he stated that he had always been interested in cotton growing and was glad to direct his attention to it in Trinidad.

Professor Ballou asked whether a certain type of local cotton was not less attractive to the cotton stainer than other varieties and whether it would not be well to institute experiments to get this resistant type while at the same time improving the quality of the fibre.

Mr. Harland replied that there were two chief semi-wild varieties here viz: the kidney variety and the green seed variety. The kidney variety was more attractive to the stainer and was closely allied to Sea Island Cotton. Native cotton stood up better to the stainer than American cotton. He thought experiments of hybridisation with the resistant type would be of interest.

THE VALUE OF CHARCOAL.

Very few small poultry keepers realise the value of Charcoal in cleansing the fowls' system and keeping away disease. Many birds which appear out of condition owing to digestive troubles or other complaints can be brightened up and restored to health by having free access to a hopper of prepared charcoal, but as with grit, it should not be mixed with the food, forcing the birds to eat more than they require.

Prepared charcoal is sold by most dealers in poultry foods. If the birds are provided with a dust bath of ashes it will be noticed that they will readily pick out small particles of charcoal or wood ash while dusting themselves. Green sticks make the best charcoal, and in preparing it at home, the best method is to enclose a few at a time in an old tin box and embed it in the middle of the kitchen fire overnight. By the time the fire is raked out in the morning the charcoal will be found ready for use. The charcoal should be supplied in a hopper in the same way as grit and shell.—*South African Poultry Magazine and Small-holder, Vol. XVIII., No. 150.*

DRAINAGE AND CROP PRODUCTION IN INDIA.

BY

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The present may be described as the era of reconstruction. Ideas which were current five years ago have since been proved obsolete. Agriculture, which is concerned with the production of food and of raw materials, is now recognized as one of the key industries of the modern world whose development must be fostered by all the resources of the State. One of the main problems before the Indian Agricultural Department is the discovery of the best means of making the soil yield a higher dividend. This involves the recognition of the factors which limit production over large areas and the discovery of the best way of putting them out of operation. One of these limiting factors is defective soil-aeration. At the Lahore meeting of the Indian Science Congress, one of the subjects discussed was the aeration of the soil and its bearing on flood irrigation in the arid regions of North-West India. It was shown that successful irrigation involves more than the mere application of water and that the aim of the irrigator should be *the provision of water in such a manner as to interfere as little as possible with the aeration of the soil.* The present paper attempts to deal with another aspect of soil-aeration, namely, inadequate drainage—a matter of particular importance in many parts of India. Over large areas nourished by the monsoon, this factor bars progress. Its removal, however, is a matter which often lies outside the scope of the Agricultural Department and its mere consideration involves a multitude of other interests—those of the cultivator, the landowner, the revenue authorities, the engineer and the sanitarian. As the years pass, we are more and more impressed with the importance of drainage in the agricultural development of India and the present opportunity is taken of bringing the subject forward once more. The connection between drainage and soil-aeration is not always clearly recognized. The essence of drainage, from the plant's point of view, is the maintenance of the oxygen supply of the soil water. In the case of ordinary dry crops like wheat, all that is necessary to bring this about is an adequate gaseous exchange between the atmosphere and the pore-spaces. In water culture, of which rice is perhaps the best agricultural example, it is essential that there should be a very slow movement of oxygenated water round the feeding roots. Sometimes, when the country is flooded, dry crops have to change over for a time to water culture. As long as the flood water is in movement and the aeration of the roots is provided for, little or no damage results.

In the plains of India, defective drainage arises during the monsoon from two distinct causes. In the first place, where the soils are on the stiff side, local surface accumulations of rain-water rapidly lower the fertility. In the second place, the sub-soil water often rises to such an extent at a time when the flow of the rivers is impeded that little or no general drainage is possible over large tracts of the alluvium. These two aspects of the subject will be considered separately.

SURFACE WATER-LOGGING.

On the stiffer loams of the Gangetic alluvium, local unevennesses in the crops are very common. Any partial holding up of the surface drainage by irrigation channels and any slight concavity of the fields, due to depressions or to the misuse of iron ploughs, are invariably followed by poor weak growth which exhibits all the characteristics of nitrogen starvation. That the loss of fertility is largely due to denitrification is proved by the results of an experiment carried out at Pusa in 1910. In that year, a plot of heavy land was purposely water-logged during the month of September in order to compare its behaviour with normally managed land on either side. Across the middle of the plots a strip was manured with 4 cwt. of nitrate of soda to the acre just before sowing the wheat. The effect of a month's water-logging was to reduce the yield of wheat by about 16 bushels to the acre.

In another case at Pusa, a portion of a rather stiff piece of land was similarly water-logged during September, 1917 and sown with Java indigo the following month. The effect of the water-logging on this leguminous crop was very marked. Five months after sowing, equal areas on the water-logged and control plots were taken and the heights of the plants were measured. On the water-logged plot, the average height of 200 plants was 10·4 cm., on the control the average height of an equal number of plants was 28·0 cm. When the root-system of the plants on these plots was examined it was found that the first effect of water-logging was to restrict the roots to the upper layers during the first few months of growth and to change the general character of the root-system.

The loss of fertility through denitrification is not the only consequence of surface water-logging. The physical texture of the soil is profoundly affected and when the land dries it is difficult to obtain the ideal crumb structure. The clods do not readily break down under the beam and the soil is gummy to the feel. Colloidal substances appear to be formed under these anaerobic conditions which not only hinder the formation of a good tilth but also prevent percolation. It is quite common at Pusa after a very heavy monsoon to find the pore-spaces near the surface almost entirely filled with water for some considerable time after the level of the rivers and of the ground water has begun to fall. The surface soil does not seem to be able to drain. An improvement in the texture follows if the surface drainage is improved and in cases where organic matter has recently been added to the soil. The gummy substances do not then seem to be formed to any great extent and the clods readily break down. These matters urgently require exact and careful investigation and it is difficult to suggest a more promising field of work for the soil physicist in India.

The extent of the annual loss in the plains of India due to surface water-logging will be apparent if we consider the benefits which result from improved surface drainage through the adoption of the Pusa system. This method consists in dividing up the area to be drained into units not more than four or five acres in extent separated by trenches. These trenches are about four feet wide and two feet deep with sloping sides and grass borders. The run-off passes over these grass borders and is led away to low-lying rice areas while most of the silt is retained on the field. By this device, each field has to deal with its own rainfall only and the run-off is strictly controlled.

The improvement in fertility and in the case of cultivation which results from surface drainage are almost past belief. The Botanical Area at Pusa has been transformed by this means. The yields have increased, the plots produce even crops and the tilth of the stiffer areas, which was formerly poor, is now vastly improved. Several of the estates in Bihar have adopted this system which the surrounding cultivators are now copying. As an example of the results obtained, the following report, dated November 16th, 1914, from the Manager of the Dholi estate may be quoted :—

"I have now some 500 bighas at Dholi and my outwork, Birowlie, drained by surface drains on the Pusa system.

"The improvement of all the lands is very marked, especially at Dholi where most of the lands are on a slope and the high lands suffered from loss of soil from rain-wash and the lower lands used to be water-logged at the time when they should be cultivated for *rabi* and indigo crops.

"The advantage derived from the drainage is most marked in the low-lying lands which were formerly my poorest lands and these last year gave me as good or better returns of wheat and indigo than the high lands; and I am certain will still further improve. These lands I am now able to keep cultivated through the rains and to sow them at the same time as the higher lands."

The most convincing proof however of the advantages of the adoption of this system on the Bihar estates is to be found in the rents paid by the tenants of drained land. On the Dholi estate, several areas, which previously could not be let to tenants at all and which had to be put under cheap crops like oats, fetched high rents when surface-drained. In 1914, one of these drained areas under chillies was let for ninety rupees a bigha, another under tobacco for one hundred and fifty rupees a bigha. The improvement in soil-aeration which followed the construction of the surface drains thus rendered possible the substitution of money crops for cheap crops.

THE PREVENTION OF DRAINAGE.

Another aspect of drainage must now be considered As the rain-inundated region of the Gangetic delta is approached, a well-marked rise in the sub-soil water-level takes place after the monsoon has set in. This is particularly the case in North Bihar where the flow of the rivers is soon checked by the rise of the level of the Ganges. The result is that the rivers overflow and the low-lying areas go under water. The rise in the level of the rivers is followed by a rise in the water-level of the wells.

Bihar ground-water and river-level curves have proved to be of particular interest in the study of the wilt disease of Java indigo. It is found that this deep-rooted plant ceases to thrive when the general drainage of the country stops and often dies off altogether due to wilt. It appeared from numerous observations in the field that indigo wilt is caused by water-logging which leads to the destruction of the fine roots and root nodules. This view has been established by direct experiments in lysimeters in which the drainage can be stopped at will. At the beginning of the monsoon of 1918, Java indigo was grown in two sets of lysimeters. In one set, alluvial soil obtained from the Kalianpur farm near Cawnpore was used, in the other set, light Pusa soil was employed. The Kalianpur soil is exceedingly rich in available phosphate (0·318 per cent.) while the Pusa soil, when analysed by Dyer's method, gives very low figures for available phosphate (0·001 per cent.).

The results may be summed up as follows:—

(1) In both Pusa and Kalianpur soil the indigo in the lysimeters with free drainage escaped wilt.

(2) When the drainage openings were closed and water-logging from below took place, all the plants were wilted in both Kalianpur and in Pusa soil.

(3) The wilt in the Kalianpur soil (rich in available phosphate) was much worse than in Pusa soil (said to be low in available phosphate).

(4) The growth in Kalianpur soil was much slower than in Pusa soil.

In these lysimeter experiments, the stoppage of drainage brought about an interesting change in the root-system of the indigo and caused the lateral roots to run near the surface.

SUB-SOIL DRAINAGE.

Another aspect of drainage must now be briefly considered, namely, sub-soil drainage by means of tiles. The openings for this system in India under present conditions are however much fewer than for surface drainage. The cost per acre of laying tile drains is considerable and further, if the work is to be of use, it must be well done. Sub-soil drainage would naturally only be attempted if surface drainage is found to be insufficient to improve the aeration of the soil. The heavy, black soils of peninsular India afford perhaps the best opening for this class of soil improvement. As is well known, these soils expand when wetted and the crops only do well if the amount and distribution of the rainfall is particularly favourable. Heavy, long-continued rain is almost as harmful as actual famine conditions. Particularly is this the case with cotton which never yields well in wet years. Interesting and valuable results have been obtained by Mr. Allan on the heavy black soils at Nagpur where, by means of sub-soil drainage, marked improvements have been shown possible. By means of shallow sub-soil drains, Mr. Allan obtained the following advantages :—

(*a*) Surface cultivation is rendered possible even in wet years and the land can be kept clean.

(*b*) The crops grow faster, are healthier and yield better.

(*c*) The root development is improved and the resistance to drought is increased.

Mr. Allan's results were obtained on the ordinary heavy black soils at Nagpur. The most productive of this class of land, however, are the garden lands irrigated by wells or tanks. These fields are very valuable, are often well cultivated and large quantities of manure and irrigation water are annually applied. They suffer little from erosion as they are constantly under crop, the surface is generally even and the area of each field is small. By means of sub-soil drains discharging into irrigation wells it *might* be possible not only to increase the yield and the number of crops per year but also, by improving the aeration, to diminish the amount of manure and irrigation water required. There seems to be a very promising field of investigation in developing the rich garden lands of the Bombay Presidency and the old poppy fields of the Malwa plateau. Already a great deal of capital has been sunk in these fields. Their owners are often well-to-do men who could easily afford to sink some of their savings in sub-soil drainage if this proves to be a success. The matter is one well worthy of careful investigation.

THE WIDER ASPECTS OF DRAINAGE.

While the cultivator can often do a certain amount to improve the surface drainage of his fields he is quite unable to cope with the larger aspects of the subject. Observations indicate that in many parts of India the surface drainage of large areas is defective and the crops suffer from poor soil-aeration. In some cases, this is due to the existence of extensive shallow, cup-shaped depressions which are unable to discharge the run-off quickly. In others, the general surface drainage is partially held up by roads, embankments and by bridges provided with insufficient water-way. Such problems are clearly beyond the means of the zamindar. They need for their solution the services of the engineer. A detailed drainage map of the area to be improved is obviously the first condition of success. From an inspection of some of these areas in the plains it would appear that a great deal could be done by the provision of a system of drainage canals by which the run-off can be passed either into rivers or led slowly through rice areas at a slightly lower level.

The difficulty in matters such as these is to make a successful beginning. The first step appears to be the study of the general drainage of a few of these partially water-logged tracts of the alluvium, the preparation of a drainage map combined with a study of the rivers where this is necessary. The drawing up of definite working-plans would follow and progressive landowners would probably be found who would be willing to execute a small project under direction. These proposals do not involve a great deal of expense. A certain number of engineers with the necessary agricultural insight in all probability exist in the country now and, if set to work on this question, would rapidly justify themselves. Their assistance in this matter is essential. The cultivators and zamindars are so intent on their own small areas of land that they cannot be expected to evolve a scientific scheme of drainage for the country-side. Clearly it is for the State to provide a directing hand. In this direction a step forward has already been made by one Indian province. In the *Punjab Government Gazette* of September 28th, 1918, the constitution and duties of a Drainage Board for the province were announced. In the Government Resolution on this matter it is stated that "water-logging is due to many other causes than seepage or over-irrigation from canals, for instance imperfect natural drainage or the obstruction of natural drainage by roads, railways, irrigation channels and zamindars' embankments. The evil is of steady growth in parts of the province and in some places threatens not only the prosperity but the health of the rural population and involves also serious loss to Government revenue. Hitherto it has been dealt with only spasmodically. There has been no settled policy either for investigation or for action. The question should, therefore, now be taken up for the province as a whole."

NATIVE BIRDS OF GEORGETOWN.

BY J. J. QUELCH, B.SC., LONDON. C.M.Z.S.

(*Concluded,*)

Quite different from the preceding tyrant birds, but inhabiting the same districts on the outskirts of the city, are the little spine-tails commonly known as rootie (*Synallaxis cinnamomea*), evidently so named from its cry. They are about 5½ inches in length, of a rich rusty-red above, with white under surface and with a yellow chin. The tails are very spiny, the shafts of the quills projecting some distance beyond the plumes. The bill is long and slender.

These little spine-tails are the only town representatives of the large family of American bush creepers or spine-tails (*Dendrocolaptidae*), which altogether number more than 200 species. They are usually, throughout the family, of some shade of brown; and in their bills, feet and spiny tails, the typical forms approach the true creepers of the Old World, with which they closely agree in habits. They are, however, chiefly forest birds, and but few of them, as in our common rootie, resort to the reeds and rushes in open swampy lands, and to the low bush in waste or grassy places.

Of the large groups of the cotingas or American chatterers, and the manakins, which furnish so many of our most brilliantly and distinctively coloured forest birds, there are no representatives to be found about the town, but of the large group of the American bush-shrikes and ant-thrushes (*Formicariidae*), which, as a rule, are confined to the dense forest, one large and typical species, known as check-bird (*Thamnophilus doliatus*), occurs, and by no means sparsely. This bird is about 5½ inches in length, and is readily recognised by the close white and black bands which cover the whole body above and below in the male, alternating with each other, while the head is black with a concealed crest of white feathers. The females are very different from the males, the plumage being of a prevailing rusty-red tint with dark striations on the neck, while below it is of a pale reddish yellow, with pale black striations on the throat.

The check-bird, like the members of the family generally, has a strong, hooked, shrike-like bill, with which it can protect itself even against the birds of prey which it attacks and pursues with a loud, harsh cry. It feeds upon insects generally, larvae and ants included; and is a lively bird, constantly on the move, uttering a by no means pleasing cry, made up of a succession of harsh and loud sounds, like the other songless birds generally.

Up to this point, only the members of the great order of the *Passeres* have been considered, but there are representatives of many of the other orders. Thus among the great oronoque trees in the Botanic Gardens, a small woodpecker (*Picumnus spilogaster*) will almost always be seen, jumping about from branch to branch, and climbing up and around, tapping the bark with their little bills, making the characteristic sound of the woodpecker's knock, though much fainter than made by the ordinary members of the group.

These little birds, though possessing the wedge-shaped bill and the zygodactyle feet, two toes forwards and two backwards, of the group of Picarian birds, have soft rounded tails, not the stiff sharpened spiny tails characteristic of the family. They are about 3½ inches in length, brown above, crossed by indistinct yellowish and reddish brown bars, with a black head, the feathers having scarlet tips in the male, and the nape tipped with white; while below, they are barred with black, the hinder parts being blotched with the same colour.

In various parts of the town, but very commonly on the outskirts, five species of the family of the cuckoos are to be found, two of which are forms of the genus *Croto-*

phaga, characterised by keel-like crests on the upper part of the beaks. The smaller species (*C. ani*), about 12 inches in length, is one of the commonest of our birds, both in town and elsewhere. In these, the crest of the bill is continued from base to tip; while, in the larger and less common form (*C. major*) about 18 inches in length, the crest is depressed towards the middle and gradually becomes lower to the tip. They are both of a deep black colour with violet-blue reflections, which are brighter, and much more definite in the larger species especially on the wings, tail and under surface of the body. The greater number of the feathers on the neck, shoulder and breast, are patterned on the edges with paler coppery or bronze blue, much more marked in the large species.

The habits of these two birds are somewhat different —the commoner species living in large flocks, and even building their nests together gregariously, and frequenting the pastures and roads as well as the low bush, especially where cattle are kept, in search of larvae and other insects; while the larger are seldom seen more than two together, not on the ground, but in the high trees and tall shrubs.

The flesh of these birds, owing to an unpleasant flavour, is not considered good for the table; though it is used among the older black creoles as a medicine for those subject to fits, for whom it is supposed to the extremely beneficial.

Another common member of this family is the bird known as wife-sick (*Diplopterus naevius*), about 10 inches in length, which is often to be heard among the bushes whistling out the melancholy notes from which its common name is taken. The beak is rather short, and the tail long and graduated. The head is crested with black and red and furnished with a pronounced white upper eye-streak, and the upper surface is marked with dark centres to the feathers outlined by reddish-grey. The under parts are white or greyish, with a reddish-brown tinge on the front of the neck. They feed chiefly on insects, and they will often be noticed catching these on the ground or among the bushes.

The remaining cuckoos are two species of the genus *Coccygus,* and are commonly known by the name baby-birds. The smaller (*C. americanus*), less than 12 inches in length, is of a shiny coppery brown above, with a white or greenish-white under surface; while the larger (*C. minor*), more than 12 inches in length, is of a pale shiny brown above, with a pale bluish grey head, and with the throat brownish white, the rest of the under surface being of a pale reddish-brown or yellowish tint. The tails are long and graduated in both species, black or brownish black, with large white spots. The bills are long, curved, and black, the under mandible being yellow at the base. These birds are sometimes seen among the large mango and sour-sop trees about the town, where, except they are in the act of catching insects, they remain as if dead to their surroundings. The name foolish-bird is also applied to them. Like the other members of the family they are typically zygodactyle.

Occasionally, the large collared kingfisher (*Ceryle torquata*)—easily recognised by its large size (about 16 inches in length), its crested black-streaked head with long wedge-shaped formidable bill, its prevailing blue colour, white spotted behind, its white throat and collar and its rusty-red belly—together with the small green kingfisher (*Ceryle superciliosa*)—recognised by its small size, its prevailing bronze-green above, its short-crested head with a red spot before the eye, while the under side is of a rusty red in front with a collar on the sides of the neck, and pure white behind, the breast being crossed by a green band in the female—will be seen either near the lakes in the Botanic Gardens or along the Lamaha canal at the back, perching on the branches or dry sticks overhanging the water; but as these are only rarely to be seen, and are few in number, no more detailed mention of them is necessary.

Very occassionally, the long-tailed paradise jacamar (*Urogalba paradisea*),about 11 inches in length will be met with about the bushy parts on the outskirts of the town, but these are evidently, from the very rare occasions on which they are seen, but casual visitors. They will readily be recognised by their long, sharp and straight, triangular bills, their bluish bronze-green plumage above and below, the brown tint on the head, and a large white gorget beneath, while the tail and especially the two central feathers are extremely long. They are quiet, sluggish, insectivorous creatures, and are generally seen perching in the same place for long periods.

One of the most important of the families of the Picarian birds is that of the humming-birds (*Trochilidae*), which, with the swifts (*Cypselidae*), are often separated into a distinct group, the Macrochires, owing to the great development of the wings, the arrangement of the feather tracts, and other characters in which they agree with each other.

The humming-birds are easily recognised by their thin, generally elongated bills, which in the young nestlings are quite short with a wide gape like the swifts; their thin and small feet, rendering them incapable, like the swifts, of perching on the ground; their long and pointed wings of 10 primary quills, moved by immense muscles, enabling them to maintain a sustained flight and to remain, as it were, almost stationary in the air for long periods; their 10 quilled tails; and their bifid tongues, moved by long occipital muscles, as in the woodpeckers They are fierce, pugnacious birds, often fighting with each other, and frequently attacking and pursuing large tyrannical birds, such as the kiskadees and the hawks. Their food consists chiefly of insects, which they pick out of the nectarine parts of various flowers.

The various parts of the plumage of the humming-birds, such as the head, neck, back, throat; cheeks; breast, belly and tail, as a general rule, present some of the most brilliant colouring to be found throughout the wide domain of nature; but it is a noteworthy feature, that in nearly all these parts, the full blaze of brightness is only perceivable at different angles of inclination to the eye, so that the richness of each part is only perceived separately. This is in marked contrast to the representations given in the various works on these birds, where for purposes of identification, all the possible tints to be obtained, are exhibited as obtainable at the same time, forming pictures of unsurpassable, but of utterly unobtainable beauty. Many of the most ornate, when looked at in certain positions, often present an altogether dull appearance in all parts, though when inclined and seen against the light, their sheen is perfectly dazzling.

About a dozen species of these birds may be obtained in or around the town, though many of them are only seen at rare intervals about the trees and the flowering plants on the outskirts of the city. Such is the case with two species of the hermits which are easily recognised by their elongated curved and coloured bills, their dull green and reddish-brown plumage and their long white-tipped graduated tails. The larger species (*Phaethornis superciliosus*) is about 6 inches or more in length, with a very long bill and the two central feathers of the tail very elongated; while the smaller (*Pygmornis longuemareus*) is about 3½ inches in length, with the central tail feathers but slightly longer than the others.

The broad-winged sabre-wings (*Campylopterus largipennis*) are equally as uncommon as the hermits. They will at once be known by the very broad and flattened quills of the primary feathers, and their unforked tails. They are about 5 inches long, green above and greyish below, the outer tail feathers being broadly tipped with white, and their bills long and strong. These are some of the most pugnacious of the family.

The mango humming-birds (*Lampornis*) are extremely common about the town, and two species, nearly 5 inches in length, are at times obtainable whose brilliant metallic violet-blue, bronze-green and red tails will easily mark them. In both species the bills are long and strong, and the upper surface of the body is of a rich grass or golden green colour.. In the one (*L. violicauda*) the throat and breast are of a deep blue-black, fading into deep blue at the sides, while the belly is grey with a central black longitudinal stripe; and in the other (*L. gramineus*) the throat is deep grass green with a black breast, and grey belly with central black stripe. The females are pale grey below with a central stripe of black, while the young males are to be found in various changes of plumage between the colours of the two adult sexes. A common stage, which seems to persist for a long time, shews some chestnut-red on each side of the throat.

The fairy humming-birds (*Heliothrix auritus*), about 5 inches in length, are also often seen about the town. In these the bills are wedge-shaped and shorter than in the foregoing species; the upper surface is of a rich grass-green; the underneath of a pure white, spotted in the young birds; and the tail is long, especially in the females, and graduated, the outer feathers being white with black bases, and the central ones blue-black.

The ruby and topaz (*Chrysolampis moschitus*) is occasionally met with about town, but is much more common outside. The male will at once be known by its brilliant ruby-red crown, and its reddish golden throat. The female is comparatively dowdy. They are about 4 inches in length, and will be recognised by their short, thin bills, a great part being hidden by the feathers which run for a considerable distance beyond the gape.

The white-tailed golden-throat (*Chrysobronchus virescens*), about 4 inches in length, will be known by its rather long and slightly curved coloured bill, its rich golden colour above and below, the throat and breast especially tinged with green and superbly bright, and by the shining golden green tail, which is tipped with white, with the outer webs of the outer tail feathers almost entirely of the same colour. These birds well illustrate the apparent dullness of colour of many of the humming-birds when seen in certain positions, while in others, seen against the line of light, they are extraordinarily sheeny. This species is to be met with, though not commonly, on the outskirts of the town.

The emerald humming-birds (*Agyrtria*) will be known by their rather long and straight, coloured bills, their plain grass or golden green upper surfaces, their bronze and black tails and their whitish under surface, the throat being generally of a bright green. Two or three species, about 3½ inches in length, occur about town, and are very common. In one (*A. leucogaster*) which is extremely common in all parts, the throat and belly are white, the green of the sides almost meeting across the breast; while in another (*A. tobaci*), somewhat less common, the throat is of a brilliant grass green when viewed slantingly from the front, the edges of the feathers being darker.

Another emerald, which is distinguished from *A. leucogaster* by its smaller size, and much more bronze and golden green upper surface and sides, is also to be obtained. The males have coloured bills and the females black, and the species seems to be indistinguishable from *A. chionopectus*, except by the slightly darker tail and the less pale-green head. It seems to be but a variety of this form.

The blue-chinned sapphire (*Eucephala caerulea*), about 3½ inches in length, is also to be found on the outskirts of the town, though they are by no means common.

This will easily be recognised by its bluish-green tint below, deeper and brighter on the throat, while on the chin it takes on a deep pure sapphire-blue colour. The tail is dark bluish-purple, and its covering feathers above and below are bright green.

The smallest of the group to be found about the town, and fairly commonly, is a tiny greenlet (*Chlorostilbon-atala*). This is less than 3 inches in length, of a rather dull golden green above and brighter bluish-green below, with a thin and short bill, and with a tuft of white on each side across the hinder part of the belly.

Many of the commonest of the humming-birds, as mentioned above, are to be found at almost any time in the day, in the Promenade Gardens in the centre of the town, either on the wing or perching on the branches of the larger and less leafy trees. Their nests are often met with in quite low bushes about the ordinary house-gardens. Their common name among the ordinary creoles, is doctor-bird.

The swifts are represented by one species (*Chaetura spinicauda*), which is commonly mistaken for one of the swallows, whose external appearance they closely resemble, while their habits are identical. In structure, however, such as in the arrangement both of the feather tracts on the body and of the muscles of the toes and wings, in their unnotched sternum or breastbone, and in their 10-quilled tails, they agree with the humming-birds, while the swallows are exactly like the ordinary passerine birds.

In the spiny-tailed swift, the wings are very long, the total length of the bird from the tip of the bill to the end of the wings being about 6 inches. The colour is of a prevailing bronze black above and below, the rump, throat and spiny tail being paler. I have never seen these birds about the houses in the city; but when seen in the sky, they will be distinguished by their long, narrow wings and their proportionately more rapid, bat-like flight.

Three kinds of owls will occasionally be met with, one of which, the ubiquitous barn or screech owl (*Strix flammea*) is exteremly common, especially about the churches and the larger houses on the outskirts. This species will readily be known by its yellowish-brown plumage, mottled with grey, yellowish-white, orange and blackish, much paler on the under side, and by the very distinct facial discs in the middle of which the eyes are placed.

The second species (*Scops cristatus*) has been met with but once, in my experience, when two young ones were taken from the loft of a house in the Brickdam. These are large crested owls, about 18-20 inches in length, of a deep or dull chocolate-brown, or brownish-red colour, marked with blackish, and with spots of white about the head.

The third form, the spectacled-owl (*Pulsatrix torquata*), is also a large bird, of about 20 inches or more in length. Their eyes are of a deep yellow or orange-yellow. The young birds are covered chiefly with fluffy white down, changing to dark or blackish-brown above, and yellowish or pale reddish-brown below, while a white streak marks out the facial disc like a spectacle, and a dark brown band girdles the neck and breast like a collar. These birds have only been met with on the outskirts of the town.

The owls though hawk-like in many resects, are easily distinguishable by their generally well-marked facial disc, and by their toes being turned two forwards and two backwards, as in the typical zygodactyle birds. Locally they are always mentioned by the lower classes as "night-owls."

Of the carrion-feeding birds or vultures, three or four species of the genus *Cathartes* are to be obtained about the town. The common black-head or so-called carrion crow (*Carthartes atrata*) may be seen at almost any time, in the streets, on the coco-nut or other high trees, on the top of the houses, or circling over head. Very frequently also, but seldom more than one at a time, the red-headed carrion crow or turkey buzzard (*C. aura*), may be met with. These are much larger birds, about 30 inches in length, and are often referred to as governor bird, and king or governor of the carrion crows; but they cannot be confounded with the large king vulture (*Sarcorhamphus papa*) which is never found in the neighbourhood of the town.

Another species occasionally met with is the orange-headed carrion crow (*C. urubitinga*), of about the same size as the common black-head, with the shafts of the quills above and below white. It seems to me doubtful whether the yellow-headed vulture (*C. pernigra*), which is occasionally seen, is specifically distinct from this form, even though its plumage is blacker and the shafts of the quills brown above.

Of the great group of the hawks several are occasionally to be met with around the outskirts, and even at times in the city itself, or are seen flying overhead. Their food is a very variable one, from fish and crabs by the mud flats, worms and snails by the trenches, lizards, rats, etc., in the fields, to living birds which they tear to pieces during the shrieks of the victim.

The two most conspicuous are two large brown and red buzzards, about 20 inches in length, which, from their frequenting the mud-flats chiefly in search of crabs, fish, etc., are commonly known as crab-hawk and fish-hawk. In the one the black-headed buzzard (*Buteogallus aequinoctialis*), the upper surface is of a prevailing ruddy and black tint, with black head, rump and throat, and with ruddy under surface finely barred with black; while in the other, the black-necked buzzard (*Busraellus nigricollis*) the prevailing colour is chestnut red, the feathers with black stripes, those of the head and neck all round of a yellowish-white with long black blotches, while the throat is marked by a very conspicuous curved black patch.

The name chicken-hawk is applied indiscriminately to several of the smaller brown or slaty-coloured hawks, which, during early or adult life, are marked on the under surface with dark bars or blotches. One of the commonest, generally to be obtained among the courida branches or mangrove stumps by the mud-flats, is the great-billed buzzard (*Asturina magnirostris*), about 14 or 15 inches in length, of an ashy grey colour, paler below, especially on the chin, and with the breast and belly closely barred with pale brownish-red.

Another, somewhat smaller kind, is the common harrier hawk (*Micrastur gilvicollis*), of a dull blackish brown, somewhat paler on the head and neck, white below, and with the breast and belly closely barred with black; while a third, and very easily recognised form, is the common double-toothed or cckoo falcon (*Harpagus bidentatus*), of about the same size, bluish or blackish slate colour above, and deep chestnut below on the breast and belly (nearly white when young), while the upper mandible bears two teeth on each side.

Another so-called chicken hawk is the kite-falcon (*Ictinia plumbea*), of much the same size, but recognised by its bluish black above, paling to blue-grey on the head, with black feathers round the eyes, and blue-grey below becoming paler on the throat. But perhaps the commonest of these birds on the outskirts of the town is the crested or laughing falcon (*Herpetotheres cachinnans*), a larger bird of about 18 inches in length, brown above and yellowish white below, the crested head and a collar round the neck of this latter tint and streaked with blackish brown, while the throat bears a dark and rather broad cross band.

There still remain to be noticed some few species of birds which are commonly distributed about the neighbourhood of the town, and which are to be seen on almost any occasion in favourable situations. Of these, three species of gulls are chiefly worthy of note, for they will always be seen about the river side in the harbour. The large scissor-bill gull (*Rhynchops nigra*) will at once be known by the peculiar flattened (in a vertical direction) and elongated bill, from which its name is taken; while the greater tern (*Sterna magnirostris*) and the lesser tern (*S. superciliaris*) will also be easily identified from their size and plumage, the former species, about 17 inches in length, being of a bluish grey above with black head and of a pure white below; and the latter about 10 inches in length, of similar colouring, but much paler on the back, being almost white. They will be readily distinguished from the true gull (*Larus atricilla*), which is also occasionally to be seen, by their longer and sharply pointed bills.

Of the group of pigeons and doves, two species of *Chamaepelia*, known commonly as ground doves, are met with all over the town in gardens and unfrequented roads. The smaller *C. griseola*, nearly 6 inches in length, is of a pale ashy-brown above, paler and more ashy on the head, and of a pale purplish-grey below; while the larger, *C. passerina*, nearly 7 inches in length is of a dull bronze brown above, darker on the head, and much paler below, with the feathers of the head, neck, throat and breast, patterned with darker brown or black.

In the Botanic Gardens, and on the outskirts of the town, in the neighbourhood of water, the small blue grey and brown herons (*Ardea cyanura*) are always to be met with. These are commonly known as chow (ow as in how), on account of their cry, though the term shypook is just as commonly applied to them.

The foregoing birds are those which will be commonly under notice in and around the town, and it is hoped that, though but briefly diagnosed, they will be found to be sufficiently characterised for recognition by all who may be desirous of becoming familiar with our feathered friends and foes.

Many other species may at times be encountered on the outskirts of the town, and along the sea or river border, or may be seen flying overhead; but space forbids more than the bare mention of the chief of these. Such are the large white herons (*Ardea egretta*), the small white egret (*A. candidissima*), the brown booby (*Sula fusca*) the common pigeon (*Columba rufina*), the large ground dove (*Engyptila rufaxilla*), the blue quaak (*Nyctherodius violaceus*), the reddish crake (*Porzana cayennensis*), the blue moorhen (*Porphyrio martinicus*), the long-legged and long-toed spurwing (*Parra jacana*), the small spotted sandpiper (*Tringoides macularius*), the American golden plover (*Charadrius virginicus*), the scarlet Ibis or curry-curry (*Eudocimus ruber*), the bronze bush curry-curry (*Harpiprion cayennensis*), the negrocop or jabiru (*Mycteria americana*), the heri (*Ciconia maguari*), the common screecher parrot (*Chrysotis ochrocephala*), etc; but these will be seen but at rare intervals, and are therefore hardly to be included among the birds of Georgetown,—with the exception of a few species, such as the blue moorhen and the spur-wing, which, in the sheltered precincts of the Botanic Gardens, are making to themselves a resting-place and a home.

Timehri Journal, Vol. V.

AGRICULTURAL CENSUS RETURNS.

COMPARATIVE SUMMARY.

Areas Under	*BRITISH ACRES.*		
	1922	1923	1924
Sugar-cane (under cultivation) ...	60,761	55,130	57,200
Sugar-cane (reaped)	56,545	50,510	51,355
Rice (under cultivation)	49,070	34,965	29.406
Rice (reaped) ...	60,460	38,715	40,272
Coconuts	26,600	22,970	25,188
Cacao	1,370	1,903	1,900
Coffee	4,240	4,096	5,685
Rubber	2,330	2,080	1,655
Limes	660	800	710
Provision Crops ...	11,370	11,924	14,443
	CROPS.		
Sugar, tons	101,128	90,758	91,782
Rice, bags of 140 lbs.	545,360	532,400	673,610
Coconuts, No. of nuts *	22,352,000	15,923,000	12,303,000
BRITISH GUIANA.	*LIVE STOCK.*		
Horses	1,710	1,610	1,796
Asses	6,170	5,450	6,176
Mules	1,750	1,840	2,300
Horned Cattle ...	111,900	102,170	113,315
Buffaloes	190	264	175
Sheep	16,980	15,355	16,185
Goats...	8,300	7,965	9,792
Swine	12,310	11,864	12,889

* Reliable returns not available.

PRINCIPAL VARIETIES OF SUGAR CANE UNDER CULTIVATION IN BRITISH GUIANA DURING 1923, 1924, 1925.

By the Director of Science and Agriculture and the Secretary of the British Guiana Sugar Planters Experiment Stations Committee.

The following table shows the areas occupied by the principal varieties of canes under cultivation for the crop of 1925, compared with those of 1923 and 1924.

AREAS IN BRITISH ACRES.

Variety.	1923. acres.	1924. acres.	1925. acres.	Increase or Decrease on 1924.	
				Increase.	Decrease.
D. 625.	36,444	37,108	37,413	305	
Bourbon.	1,506	391	323		68
D. 625 mixed with Bourbon & other seedlings.	6,410	7,126	9,201	2,075	
D. 145.	3,969	3,496	2,649		847
D. 118.	1,978	1,656	1,576		80
B. 208.	1,101	625	403		222
R.P. 8.	844	498	461		37
Diamond 37.	312	363	316		47
B.H. 10 (12).	243	295	190		105
Diamond 185.	495	173	—		173
Ba 6032.	300	138	89		49
D. 109.	203	125	127	2	
D. 419.	606	102	84		18
Diamond 581.	85	85	55		30
P.L. 2.	64	79	103	24	
D. 179.	64	52	46		6
B. 4395.	53	52	—		52
G. Transparent.	416	38	29		9
D. 167.	50	37	51	14	
R.P. 20.	75	35	30		5
R.P. 21.	46	29	20		9
Java seedlings.	56	26	20		6
D. 199.	24	24	25	1	
P.L. 374.	16	16	—		16
Small areas of other varieties & areas under varieties unenumerated.	1,414	149	179	30	
Total Estates' Canes.	56,774	52,718	53,390	672	
Total Farmers' Canes.	1,040	2,412	* 3,800		
Totals.	57,814	55,130	57,190		

* Areas at Plns. Anna Regina & Hope transferred to Farmers' Canes.

The following table indicates the relative distribution of the various kinds of cane during the crops of 1921, 1922, 1923, 1924 and 1925.

Variety.	For Crops of				
	1921.	1922.	1923.	1924.	1925.
D. 625.	56·5	59·4	65·4	70·4	70.1
Bourbon	3·5	2·5	2·7	0·7	0·6
D. 625 mixed with Bour- D.bon and other Seedlings.	13·9	15·2	11.5	13·5	17·2
145	7.5	7·3	7·1	6·6	4·9
D. 118.	4.8	4·1	3·6	3·1	2·9
R.P. 8.	1·6	1·3	1.5	1·0	0·9
B. 208.	3·4	3·0	2.0	1.2	0·8
Diamond 37.	0·2	0.3	0·6	0·7	0·6
B.H. 10 (12)	0·2	0.3	0·4	0·6	0·3
D. 109.	0·5	0·5	0·3	0·2	0.2
Diamond 185.	1·3	1·0	0·9	0·3	—
Ba 6032.	0·3	0.4	0·5	0·3	—
D. 419.	2·7	1·6	1·1	0·2	—
Other Varieties unenumerated.	3·6	3·1	2·4	1·2	1·5
	100.0	100·0	100·0	100·0	100.0

From the returns supplied by the Sugar Plantations, the distribution of the various sugar canes in cultivation for the crops of 1921, 1922, 1923, 1924 and 1925, according to their origin is as follows:—

Variety.	1921	1922	1923	1924	1925
Bourbon and other Varieties.	8·8	8·2	9·2	4·8	5·1
Java.	1·1	0·4	0·1	0·1	0·1
Barbados.	4·4	4·1	3·2	2·2	1·4
British Guiana :—					
Plns. Diamond & Providence.	3·3	3·5	3·7	2·6	2·2
Botanic Gardens.	82.4	83·8	83·8	90·3	91·2
	100·0	100·0	100·0	100·0	100·0

The average yields in tons of Commercial Sugar per acre of the principal varieties under cultivation for the crops of 1924, as deduced from the returns supplied by the Managers of the Sugar Plantations, were as follows:—

Crops of 1924.

	B. H. 10 (12).		Green Transparent		D. 145.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	2·13	189	2·12	18	1·99	2,688
Maximum reported ...	3·20	13	2·37	4	2·50	10
Minimum reported ...	1·10	10	2·00	7	1·61	554

	Bourbon.		B. 208.		D 118.	
	Yields.	Acreage.	Yiel ds.	Acreage.	Yields.	Acreage.
Mean of all plantations	1·98	77	1·86	614	1·82	1,451
Maximum reported ...	2·72	16	2·37	271	2·51	222
Minimum reported ...	1·42	4	1·40	315	1·21	25

	Ba. 6032.		D 625.		Mixed.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	1·82	142	1·81	28,797	1·80	7,791
Maximum reported ...	3·00	30	2·91	2,575	3·00	33
Minimum reported ...	1·00	8	0·60	323	0·60	204

	D 419		D 109.			
	Yields.	Acreage.	Yields.	Acreage.		
Mean of all plantations	1·80	62	1·43	72		
Maximum reportd ...	1·87	59	1·70	50		
Minimum reported ...	1·74	3	1·13	4		

Many of the smaller plantations, owing to the small labour supply, were not in a position to keep up their cultivations as they otherwise would have done, as a result of which their crops were short. It is desirable to record separately the results supplied by the Managers of the larger and hence more favourably situated plantations. The results were :—

	B H 10 (12)		Diamond 37		D 625	
	Yields	Acreage	Yields	Acreage	Yields	Acreage
Mean, larger plantations only	2·35	163	2·32	364	2·09	22,651
Maximum reported	2·73	71	2.43	345	2·91	2,575
Minimum reported	1·68	17	2·22	19	1·59	291

	Bourbon		D 145		B 208	
	Yields	Acreage	Yields	Acreage	Yields	Acreage
Mean, larger plantations only	2.05	54	2·02	2,664	1·86	614
Maximum reported	2·72	16	2·50	10	2·37	271
Minimum reported	1·42	4	1.61	554	1.40	315

	D 118		Ba. 6032	
	Yields	Acreage	Yields	Acreage
Mean, larger plantations only....	1·84	1,316	1·82	142
Maximum reported	2·51	222	3·00	30
Minimum reported	1·21	25	1·00	8

The results of large scale field-trials with other varieties on the sugar plantations are shown in the following table:—

Varieties.	Average.	Yield.
Diamond 581.	81	3.02
Diamond 37.	345	2.43
D. 376.	10	2.30
Java.	5	2.18
Diamond 185.	164	2.14
P. L. 2.	61	2.09
R. P. 8.	426	2.05
D. 179.	44	2.00
D. 167.	17	1.95
B. 3412.	15	1.90
R. P. 20.	33	1.84
R. P. 11.	27	1.57
P. L. 264.	16	1.31
P. L. 374.	15	1.22

THE ROLE OF PLANT PHYSIOLOGY IN AGRICULTURE.*

By Gabrielle L. C. Howard, M.A.,

Second Imperial Economic Botanist.

I wish to take the opportunity to bring before you a branch of botany which offers a wide and interesting field of work. As the immediate need, when agricultural investigation was started in India, was for better varieties, that aspect of agricultural botany which deals with the improvement of crops is being extensively developed. New varieties have been produced by selection and by hybridization. The laws of inheritance are under investigation as well as the details of pollination and their bearing on the principles underlying seed distribution. While there can never be too many workers on the improvement of crops, I think the time has come when the claims of another side of agricultural botany, namely, physiology, should be emphasized. This seems a fitting occasion to bring physiological problems forward because they are well adapted to workers who are provided with laboratory facilities and a garden, but have not at their disposal the resources of an experimental farm. Investigations in plant breeding require an ever increasing amount of land and labour and many years of uninterrupted, time-consuming work. Further, if the results are to be of practical importance, the investigations must be continued in one locality. If economic developments are to be achieved, a large organization like that of an agricultural department is required to test and distribute the new variety. On the other hand, the physiological interpretation of agricultural practices can be pursued with much smaller means as regards land. They are not so dependent on the locality or the season and can be carried on intermittently, a great advantage where research is only one of the duties of an individual. Such investigations not only bring the worker into touch with some of the most intricate scientific questions but also into contact with the living plant and with the practical problems of Indian agriculture.

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*Presidential address, Section of Botany, Indian Science Congress, January 1923.

In agriculture, the plant is the centre of the subject. It is the visible, living agent by which the materials provided by the soil and the atmosphere can be utilized for the service of man. This fact is not always vividly realised. Modern developments in agricultural chemistry and bacteriology have brought the soil into prominence and tempt us to consider it as the active agent rather than the plant. For instance, it is customary to speak of "the soil producing a crop" or "the land yielding its increase." Attention is sometimes too exclusively concentrated on the condition of the soil without sufficient consideration of the roots which are to use it. Arable farming is the endeavour of the farmer to make the conditions such that the plant will do what he wishes. His effort is to please the plant. The application of manure and the whole of the operations connected with *tillage*, which involve an immense amount of labour and thought, are carried out with the object of preparing food materials and a habitat for the plant so that the latter may manufacture the products desired. The agriculturist is the servant of the plant. If he does not provide a comfortable domicile, properly drained and aerated, with adequate food materials and water, the plant retaliates by giving a poor return. In addition, the proportion of the various products yielded, namely, green vegetable matter, seed and fibre, depends on the environment. The agriculturist, therefore, becomes master of the plant when, by modifying the external conditions, he can make it yield the largest possible quantity of the particular product desired. The soil can be directly influenced by the agency of man by means of irrigation, aeration, cultivation and manuring. With the exception of mutilations, such as pruning, the plant can only be controlled through its environment.

EFFECT OF CHANGES IN THE ENVIRONMENTAL CONDITIONS ON THE NATURE AND QUALITY OF THE PRODUCE.

I will give a few examples of the determination of the nature of the produce by the environment. Table I. shows the effect of over-irrigation on the relative yield of straw and grain in the case of wheat.

TABLE I.

*Yield of wheat with varying quantities of irrigation Water.**

Inches of irrigation water applied	Bushels of grain to the acre	Pounds of straw to the acre	Pounds of straw for each bushel of grain	Bushels of wheat for each inch of water
5.0	37·81	2,986	79	7·56
7·5	41·54	3,301	75	6·39
10·3	43·53	3,452	79	4·35
15·0	45·71	3,954	87	3·05
25·0	46·46	4,311	93	1·86
35·0	48·55	4,755	98	1·39
50·0	49·38	5,332	108	0·99

*Widstoe. *Principles of Irrigation Practice*, 1914.

It will be seen from the figures in the fourth column that raising the amount of irrigation water from five inches to ten increases the yield of straw and and grain in equal proportions. Further additions of water give a greater proportion of straw. The fact that the actual amount of grain increases all the time shows however that the limit of grain production has not been reached. The physiological reason why over-irrigation should stimulate one form of growth rather than another remains to be discovered.

The fact that heavy nitrogenous manuring often *increases* the vegetative growth and *decreases* the amount of seed is an interesting example of the effect of environment on the type of produce. Under such circumstances, a large amount of weak, sappy growth without a corresponding increase in the amount of seed is generally produced. The evil effects on wheat are well marked in this country. With excess of nitrogen, a very leafy crop with weak straw is obtained which easily lodges and is very liable to rust. Maturity is delayed and the hot winds dry up the plant before the grain can fill. In this case, as in many others, the depressing effect of a large supply of nitrogen on the yield of seed is partly due to the prolongation of the vegetative phase by excessive growth stimulation. This rapid growth also prevents the laying down of those substances like silicates which give strength to the straw. Many cases of reduction in the yield of seed can be explained by delayed maturity but this does not seem to be the only factor. The character of the growth also alters.

The following table shows the relative percentage increase in vegetation and seed produced in some leguminous crops by an addition to the nitrogen content of the soil. Delayed maturity was not a factor in this experiment. It will be seen that not only does the effect on the seed and green parts of the plant differ but these three crops are markedly dissimilar in their reaction to the manurial treatment. The experiments were carried out in small pit cultures[1] and have been confirmed in subsequent years.

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[1] Howard, A., and G. L. C. Some methods suitable for the study of root development. *Agr. Jour. of India*, Special Indian Science Congress Number 1918.

TABLE II.

The effect of organic manure and sodium nitrate on the yield of some leguminous crops.

	INDIGO 1918-19			GRAM 1918-19			SWEET PEAS 1918-19		
	Dry weight in grammes		Ratio	Dry weight in grammes		Ratio	Dry weight in grammes		Ratio
	Veg.	Seed	Veg./Seed	Veg.	Seed	Veg./Seed	Veg.	Seed	Veg./Seed
CONTROL	68	32	2·19	719	409	1·76	994	259	3·84
ORGANIC MATTER									
Well rotted leaf mould 10 per cent. by volume	...	...	...	1,158	403	2·87	2.175	535	3·99
30 " " " "	907	577	1·56	1,136	361	3·14	2,201	526	4·19
50 " " " "	...	...	...	1,276	421	3·03	2,351	525	4·48
SODIUM NITRATE									
2 cwt. per acre ...	...	...	...	1,170	627	1·87	1.190	398	2·99
4 " " " ...	...	...	...	1,127	651	1·76	1,215	356	3·41
8 " " " ...	191	115	1·66	...	...	...	...	...	...

The converse result, namely, an increase in seed obtained by withholding nitrogen from a tomato crop is shown in Table III. The experiment was carried out at the Cheshunt Experiment Station in Great Britain.

TABLE III.

The effect of withholding nitrogen on the yield of tomatoes *

	Lb. per Plant				Tons per acre				Relative Weights
	1916	1917	1918	1919	1916	1917	1918	1919	Average 1916—19
Complete artificials	4·9	5·11	3·32	5·57	38·7	35 8	25·8	42·2	100
No. nitrogen	5·7	5·60	3·62	5·98	45·0	39·2	28·2	47·4	111

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* Russell, E. J. *Soil Conditions and Plant Growth* 1921, p. 62

There are a large number of other problems connected with the nitrogen metabolism of plants which would well repay study and many of these have an agricultural bearing.

The question of quality offers a further field of investigation in connection with the effect of change of environment. Quality in produce is generally associated with definite localities and such a reputation is one of the greatest agricultural assets a place can have. I need only mention the champagne districts of France and certain tea districts. Choice of variety does not always explain the matter. The cause lies in the environment as well but so far it has not often been possible to prove association with any particular property of the environment. Quality is generally dependent on good development and sharp ripening. It has been suggested that it may be depressed by poor soil aeration, which delays maturity. The fact that it not only varies with the locality but also with the season would point to some such factor being involved rather than the chemical composition of the soil.

Good aeration seems also to influence the flavour of fruit. Thus over-irrigation of peach trees in the Quetta valley produces tasteless fruit which does not travel well. No definite investigations have yet been carried out on the relation between aeration and quality but if the secret of good quality could be found even in a few cases the economic advantage would be great.

I have said enough to show how small our knowledge is and how many problems there are connected with the effect of change in the environmental conditions on the yield and quality of agricultural produce.

INTERPRETATION OF FIELD EXPERIMENTS.

The interpretation of field experiments is the second direction in which plant physiology can be of assistance to agriculture. We have seen that a knowledge of the reaction of the plant to its environment is essential if the farmer and not the plant is to be the master of the situation. To acquire such knowledge is one of the aims of agricultural investigation. It can be obtained empirically by the method very frequently used, namely, by observing the effect on the outturn of successive changes in the environment. The effect of various manures, modes of cultivation and additional irrigation on the yield of seed are good examples. Such experiments, when carried out under agricultural conditions, are known as field experiments and any one who has experience of field experiments knows how exasperating they are. It is one of the most difficult things of the world to obtain really conclusive and reliable results. Climatic conditions cannot be controlled, some of the soil factors are uncertain and the results in succeeding years have a most annoying habit of being contradictory. The scientific man trained in the exact habits of laboratory investigation, where conditions can be regulated, is apt to be sceptical and to lose patience. Nevertheless, to obtain results which are economically sound and to test the conclusions of the laboratory, field experiments[1] are essential. Here there is great scope for the botanist. In such experiments we are apt to focus attention on the beginning and the end only, that is, on the conditions provided and the yield obtained. We tend to ignore the changes and processes which have been taking place in the plant. This is, in reality, a selfish and brutal method of dealing with the subject. If we focus our attention on the plant and instead of regarding it as a machine which grinds out so much food for us we look upon it as a living individual completing its life cycle under certain conditions, we obtain valuable information even from an experiment in which the end result is rendered useless by some climatic circumstance.

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[1] Great efforts have recently been made to improve the technique of field experiments by calculating the probable error, by paying great attention to the shape and size of the plots and by the use of the method known as the chess board system, but all these devices, though they eliminate errors due to the unevenness of the soil, cannot deal with climatic variations. Moreover, the immense amount of additional labour and supervision required limits their execution and usefulness.

Results which seem contradictory often become clear. I will illustrate my meaning by two examples. The classic instance is the explanation of the nitrogenous nutrition of leguminous plants. For many years, scientific agriculturists had been perplexed by the difference betwen *Leguminosæ* and other plants in their reaction to nitrogenous manuring. It was not until the part played by the root nodules was discovered that these contradictory results could be explained. A similar example arose in the course of some work at Pusa. Indigo wilt, the subject of the investigation, had been shown to be due to the death of the active roots and nodules. Bad soil conditons induced by the monsoon and the rise of the sub-soil water were the chief contributing causes. The most promising remedy appeared to be improvement of the aeration and soil conditions by cultivation. Cultivation of all kinds in the hot weather and very early rains is of immense benefit to indigo. Various methods were tried in the monsoon but all were a failure. Many plants died and the remainder grew less rapidly than those in the non-cultivated plot. The same results were obtained in the following year. Apparently aeration benefited the plant in the hot weather and very early rains and positively harmed it at the end of the monsoon. The beneficial effect of cultivation was again obtained in the cold weather. An examination of the root system give the explanation of these apparently contradictory results. In the hot weather the active roots of indigo are distributed through a considerable depth of soil. About the middle of the monsoon the lower roots die and the plant lives entirely on those which lie near the surface. Cultivation during the hot weather does not cut many of the active roots. Cultivation during the late monsoon practically deprives the plant of the greater part of its active root system. Some of the plants never recover. The others have to make a new root system before they can grow. The contradictory results on the effect of aeration were therefore at once explained by the examination of the root system. Similar observations have also given practical indications as to the best time for cultivating monsoon crops In Bihar the growth period of *patwa* (*Hibiscus cannabinus*), sunn hemp, indigo and *arhar* (*Cajanus indicus*) is prolonged through the monsoon into the cold weather. The temptation at the end of the monsoon is to break up the rain-sodden ground as soon as possible and to ameliorate the soil conditions. To do this with surface-rooted plants does more harm than good. Deep cultivation should be delayed until the drying of the ground and the fall of the sub-soil water has enabled the plants to make a deeper root system. The sudden death after the monsoon of full-grown plants which previously appeared in good condition was also explained by a change in the active root system. Indigo wilt and other wilt diseases commonly make their appearance during the latter part of October and November at a time when all the conditions are most favourable for growth. The plants survive the monsoon, appear healthy in the early part of October and then unaccountably die. Such plants were found to have developed a very superfical root system. While the soil was moist they throve. When the surface soil and air became dry in November they could not absorb enough water to make good the loss by transpiration and wilted before they could form new roots. Experiments were carried out in which the soil round certain old indigo plants was kept moist by covering it with dried grass. In all cases these plants survived while many of their neighbours died.

The benefit to be obtained from a continuous examination of the plant during the course of an experiment is more difficult to illustrate but is not the less important. Its usefulness has been brought home to me by actual experience. Very great difficulties have been encountered while carrying out field experiments in a place close to a silt-bearing river which has continually changed its course in the past and where incipient alkali formation is common. The soil and especially the sub-soil vary greatly—often in the same field. Really reliable field experiments, except on very small plots, are therefore out of the question. Had the end results only been considered, namely, the yield—work would have been impossible. In making the study of the plant, the main object during the course of the experiment, the great possibilities of this line of study have become apparent. The plant is so sensitive and reacts so quickly to every alteration in the environment that it is an excellent indicator of changes taking place in the soil. Critical examination of the crop during the investigation has often revealed the existence of some limiting factor which was affecting the results, for instance the existence in certain portions of the field of a hard pan far below the level of cultivation. Another illustration may be given from some manurial experiments on tobacco. The experimental conditions were apparently perfect but it was noticed that in one corner of the field the plants were poor. Exploration of the sub-soil showed that a layer of sand passed under the land at a depth of three to four feet. The water from the flooded rice fields, which were just below the experimental area, passed up through this sand and water-logged that particular corner. Had the yields given by the various plots only been considered this would have led to false conclusions as to the effect of the manurial treatment.

The plant should be used as an interpreter of agricultural conditions to a very much greater extent than it is, but to do this much deeper knowledge than we now possess is required. It is true that a certain amount of knowledge already exists. We know that when a plant wilts in the day and recovers at night it is losing more water than it can absorb. We can also go further than that for we know that lucerne and other plants require water when they begin to show a peculiar blue green colour in the leaves. This takes place long before any sign of wilting can be observed. Tobacco plants indicate that the aeration of the soil is defective by the leaves assuming an upright position.

If the crop is deeply cultivated, the leaves relax and spread out, thus allowing a greater amount of assimilation and more rapid growth. We know by experience that this is so, but we do not know the reason why bad aeration should influence the set of the leaves. Instances could be multiplied in which very slight changes in the appearance of the leaves give valuable indications of the soil conditions affecting the roots. We require, however, more knowledge and more fundamental knowledge of the relation between the different parts of the plant. For such investigations the agricultural plant physiologist requires a vivid mental picture of the plant as a living whole. It is as much a biological unit as an animal. The latter, however, is visible as an entity and acts as an entity. If we injure any portion of it, we expect reaction and disturbance of the whole. In the plant our mental conception is blurred by the fact that one of the most important structures is underground. We do not treat it as an entity, for we continually mutilate it without troubling very much about the effect on the remaining portion.

AGRICUTURAL PRACTICES WHICH ARE MUTILATIONS.

This brings me to another class of investigations, namely, the effect on the metabolism of the plant of those agricultural processes which are really mutilations. The cutting of green fodder, the plucking of tea, the pricking of the poppy capsule, the grafting and budding of fruit trees, root pruning and the grazing of young wheat are examples. One of the most interesting of these is the frequent reaping of fodders like lucerne. Here extremely rapid growth is induced and when the growth is almost completed or even when it is at its height, the whole of the upper portion is cut off. This operation must produce a most profound disturbance in the metabolism of the plant. The entire supply of carbo-hydrate material is suddenly removed while the full complement of roots with their power of absorption of water and salts and their need for carbo-hydrates is left. How does the plant adapt itself to this tremendous change? Apparently, it does not suffer, for green shoots are very soon produced again and the mutilation can be repeated many times during the year. What is, however, the effect on the roots? Interesting information on this point was obtained in the case of indigo which is treated in much the same manner as lucerne. If the roots of indigo are carefully exposed by a spraying machine a few days after the crop has been cut back, it would be found that at least half the active root system and all the nodules have been killed. The plant then slowly makes a new root system and finally shoots. If very young plants with thin stems are cut back, they are unable to repair their root system and the plant dies. Older plants with thick woody stems survive. Fewer roots are killed and the plant shoots more rapidly if a side branch with two or three leaves is left at the time of cutting. It would be interesting to know to what the death of the roots is due. Is is caused by starvation from lack of carbohydrates? The fact that the individuals with thick woody stems, that is, with reserves to draw upon, survive, would point to this being a factor. On the other hand, the assimilation of the few leaves left after cutting back seems hardly sufficient to account for the beneficial effect. Is it due to the sudden dislocation of the transpiration current? Considering how many agricultural processes are really mutilations and how often we employ mutilation to increase fruit formation, it would be interesting to have more exact information on the changes induced in the metabolism of the plant. Knowledge of this kind might lead to important modifications in current practices.

INCIDENCE OF DISEASE AND THE PHYSIOLOGICAL STATE OF THE PLANT.

Another very fruitful line of research lies in the relation between the incidence of disease and the physiological state of the host plant. As a very interesting paper by Dr. Shaw of the Pusa Research Institute is to be read on this subject in connection with fungoid diseases, I will only give briefly two examples taken from insect pests. It has frequently been noticed that attacks of *Aphides* can be correlated with defective aeration of the roots of the host. At Quetta, green-fly is one of the great pests of the peach but it was found that only the over-watered trees suffered. Similar trees alongside which were given a minimum amount of water were not attacked. When however the irrigation was increased, such immune trees in their turn were soon covered with green-fly A large number of specially designed experiments bore out these observations. Similar results were obtained at Pusa last year with *Lathyrus sativus.* In connection with some investigations on the cause of lathyrism, samples of this crop from various parts of India were collected. These were sown in one small plot. During the course of the season, an attack of *Aphis* supervened but it was found that only those varieties which came from the Central Provinces were badly attacked. Local varieties were untouched and those from stations between the Central Provinces and Bihar only suffered to a small extent. Examination of the roots showed that, without exception, the most susceptible varieties had deep root systems unsuited to the wet, close soils of Bihar while those immune had shallow ones.

Correlation between the condition of the host and incidence of disease has been observed in other countries. A change in the composition of the cell-sap has been suggested as the cause. This seems a very probable explanation but only leads to the further problem of the effect of root aeration on the metabolism. Further, is it the want of oxygen or the excess of carbon dioxide or some other factor which is the real agent?

The fact that these two varieties of *Lathyrus sativus* possess two such very diverse root systems brings out another point.

It is obvious that the soil requirements of these types are very dissimilar. If the physiological demands of two *varieties* are so distinct how much greater may not the difference be between two *species*. Yet in agricultural work it is not unusual to group species together as cereals, leguminous fodders and so on, and to speak as if their requirments and physiological needs were alike. Conclusions as to the behaviour of a group of plants are sometimes drawn from experiments on one variety. Many misconceptions have arisen from this habit of generalization. A third vivid conception which is necessary for work in agricultural plant physiology is therefore the recognition of the physiological individuality of species and varieties.

There are two other problems—acclimatization and change of seed—which are still unsolved although they are of fundamental importance. These can only be recommended however to those who can look forward to many years of work.

ACCLIMATIZATION AND CHANGE OF SEED.

We are all familiar with the terms acclimatization and acclimatized seed. They occur all through the literature of agricultural investigation in India and have a well-known popular meaning, but what do they really denote scientifically? I am here referring not to acclimatization of a special individual but acclimatization which produces offspring more adapted to the new climatic conditions than the original parent. Acclimatized seed is said to be and is less delicate and more suited to the locality than the seed of the same plant when first introduced. Very often the beneficial effect is due to the elimination of unsuitable types from a mixture of forms. Every year a number of the unthrifty individuals die out and the remainder give less seed than those which suit the environment. Thus the acclimatized seed does better than the freshly imported. A change in appearance is produced if the imported seed is a mixture of types morphologically different. One of the first problems we were asked to solve in India was the alleged change of white wheat to red in certain places. It was found on examination that all the samples of white wheat contained a very small percentage of a pale red kind which happened to suit the new locality and gradually ousted the white. Cross-fertilization is another fruitful source of change of type in acclimatization. The individuals composing the mixture may be heterozygotes or heterozygotes may develop during acclimatization. Further, the mixture may consist of types not apparently morphologically dissimilar but differing in their root systems or in their physiological attributes such as earliness and immunity to disease. In this case we may secure a benefit from acclimatization without change of type. Is there any acclimatization effect beyond this?

Change of seed is another aspect of the same subject. It is well known that some crops such as certain varieties of sugar cane and potatoes when grown for several years in the same locality deteriorate and the original benefit of the introduction is lost. If sets from these deteriorated plants are grown for one season in a colder climate and then brought back, the original vigour is restored. This practice is followed in Java with sugar cane and in the planes of India with potatoes. There seems no doubt about the facts. No explanation of hybridization or mixture can apply as the reproduction is vegetative. In both cases large amounts of reserve material are laid down. Does the explanation lie in the fact that the hot climate prevents the accumulation of this reserve material in a certain quantity or in a certain form or is some climatic influence on the enzymes involved? Both these factors have been suggested as the explanation. This question is interesting and important and very little has been done as yet to elucidate it.

I hope I have said enough to show how wide and interesting a field there is in the interpretation and modification of agricultural practices by the application of a knowledge of the biology and the physiological processes of plants.

—*Agric. Jour. of India, Vol. xviii., Pt. iii*

DEVELOPMENT OF MANLESS PLOUGHS.

READING that is almost fascinating in its interest is contained in a paper that was contributed, says Chicago *Farm Implement News*, at a meeting of the American Society of Agricultural Engineers, and in which mention was made of the fact that two agricultural engineering students in the United States had built ploughs of the "manless" type. One of the manless ploughs consisted of a two-wheel tractor with a four-h.p. single-cylinder engine to provide the power. Right and left hand plough breasts were attached to the frame, had their beams opposite and nearly at right angles to the tractor axle, and were so placed that while one was in work the other was carried above the ground surface. In operation the outfit was steered by hand for the initial furrow, after which the first furrow served as a guide for the plough. The success of the plan was fully demonstrated, for a driving wheel will only rarely leave a furrow wall and the furrow does not need to be particularly deep to control a plough in this manner. The machine travelled back and forward in the shuttle style. A reversing arm or antenna hung over the tractor and extended out some distance beyond the machine in each direction. This reversing arm, upon coming in contact with a fence or other obstruction, was pushed back to a point where spring action came into place and reversed the direction of the driving mechanism. The reaction immediately lifted the breast in work out of the ground and swung in the other one, a proceeding that took place quite smoothly and positively. One problem in connection with the operation of the machine was that of moving the tractor over across the direction of travel the width of one furrow each time the machine was reversed. This was secured by causing the driving wheel on the ploughed ground side of the tractor to make a part of a revolution with the driver on the unploughed part acting as a pivot. It was found that to put a machine of this kind into actual service some safety devices would be necessary, such as making provision for the stopping of the engine should the plough leave the furrow. The inventor has worked out a simple means of doing this.

The second manless plough was the result of the study of a machine with a stationary motor using cables. This machine consisted of a skid carrying an electric motor and reels for the main cable used in drawing the implement to and fro across a field, an anchor skid upon the opposite side of the field carrying a pulley, reels on the motor skid for moving the power skid and anchor skid forward at the precise time, reversing mechanism to the motor and intermittent drive to the reels for moving the skids. The mechanism for moving the power and anchor skids was one of the most ingenious parts of the machine. This device moved the skids alternately every time the motor was reversed by taking in cables attached to the anchor at the corners of the fields. The skids were held in place by one runner following a furrow. It is suggested that when such an outfit has been thoroughly tried out and perfected there is no reason why it should not work continually for a 24-hour day.

HINTS FOR THE HOME.

ORANGE MARMALADE.—12 thin-skinned oranges, 3 lemons. Wash fruit and wipe it. Take out the pulp with a sharp spoon, discarding seeds and rag, and either put the rinds through the grinder, using coarse or fine cutter as you like, or cut it in match thin strips by hand. To each 2 cups of pulp and rind, measured all together, allow 3 cups soft fresh water. Cover and stand overnight. In morning bring to boil and cook slowly for 2½ hours. Now strain off liquid and measure your pulp, adding to it measure for measure of sugar. That is, equal measures of the semi-solid pulp and sugar. Pour liquid back on to the pulp and sugar, and cook slowly from ½ to 1 hour, or until it jellies when tried on a cold saucer.

THREE-FRUIT MARMALADE—Take 1 orange, 1 grapefruit, 1 lemon. Select tender skinned bright-coloured fruit, and let me say that much depends on the skin of citrus fruits used in marmalade making. The thin tough varieties never cook tender, but grow harder by being cooked in sugar with the acid. I used a fairly thick rind for mine. Wash, wipe, and remove the peel. This is best done by scoring it down in sections of eights or quarters, and taking it off as whole as possible. Cut the peel into very thin strips, using a sharp knife and a wooden board to cut on. Put all this peel into cold water to cover, let it boil up for 5 minutes and throw away water. Repeat this, using fresh water each time. This is to get rid of the bitter taste. Meantime break up the pulp saving all the juice, but discarding every bit of seed or rag, and put this pulp and juice with your cooked peel. To each measure of the combined mass add 3 times as much water and boil fast for 25 minutes; then measure again and add as much sugar as you have pulp and liquid; stir till sugar is dissolved, then let boil up again for about 25 minutes or until the jelly test shows it to be jellied. I put a saucer in the refrigerator and when ready to test drop a teaspoon of the cooked liquid on the cold saucer, tilting it. If the juice runs and continues to run it is not done. If it grows thick and settles on the edge of the cold saucer it is ready to put in glasses. I dip it into scalded jelly glasses and when it is cold cover with paraffin. This marmalade should be of a clear golden colour, not brown or bitter, and the strips of peal should be transparent.

SANDWICHES can be kept as fresh as when first made, by wrapping them in a napkin wrung out of hot water and then placing them in a cool place until they are needed.

Most people think that a sandwich must contain meat—principally ham—But a cheese sandwich is nice, and better than all is a cool sandwich of sliced tomato and lettuce.

BAKED EGGS AND HAM.—Mixed equal quantities of biscuit crumbs and chopped ham; soften with milk and put two tablespoonfuls in the bottom of a buttered baked egg dish. Break an egg into the dish and cover the egg with crumbs mixed with melted butter, salt and pepper. Bake by placing dish on a folded paper in a dish containing hot water, until the egg begins to feel firm to the touch.

COCKROACHES ARE FILTHY PESTS.—They can be trapped, poisoned, or driven away without any great difficulty. Take equal parts of fine sugar and powdered borax; mix and sprinkle where cockroaches frequent.

"*Journal of the Jamaica Agricultural Society.*"

ATTENDANCES AT THE DISTRICT GARDENS.

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330
1925 ... 1st Quarter	1,019	1,012	337	516	412	610	709	4,615

Meteorological Data—January—March 1925.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evaporation.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
Jan. ...	3·70	10	10	2	...	...	22	4·62	82·6	73·5	78·0	79·5
Feb. ...	2·21	14	4	1	...	...	19	5·83	83·4	74·3	78·8	78·0
March ...	14·82	5	7	4	4	1	21	4·67	83·6	74·1	78·8	80·2
Totals	20·73	29	21	7	4	1	62	15·12				
Means.	...	...	...	...	...	...	...	...	83·2	73·9	78·5	79·2
Berbice Gardens.												
Jan. ...	2·69	3	7	2	...	...	12	...	88.1	73·5	80·5	77·6
Feb. ...	3·43	2	4	...	...	1	7	...	87·3	73·2	80·2	80·9
March ...	10 02	4	5	5	1	1	16	...	87·0	73·6	80·3	82·4
Totals	16·14	9	16	7	1	2	35	...				
Means.	...	...	...	...	...	...	...	...	87·5	73·4	80·3	80.3
Onderneeming.												
Jan. ...	5·62	1	11	4	...	...	16	...	87·9	71.9	79·9	...
Feb. ...	3·73	2	7	2	1	...	12	..	88.9	73·2	81·0	...
March ...	13·65	1	2	4	6	1	14	...	88·1	72·6	80·3	...
Totals	23·00	4	20	10	7	1	42	...				
Means.	...	...	...	...	...	...	...	...	88·3	72·6	80·4	...
Mora-whanna.												
Jan. ...	4·31	11	4	2	1	...	18	...	...	...	...	...
Feb. ...	·67	7	1	...	...	...	8	...	...	...	...	...
March ..	3·79	9	8	...	...	1	18	...	...	...	...	...
Totals ...	8.77	27	13	2	1	1	44	...	...	...	...	...

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first quarter of 1925.

The corresponding figures for the same period during previous years and the average for the seven years previous to that are added for convenience of comparison.

Product.	*Average 1916-22.*	*1923.*	*1924.*	*1925.*
Sugar, tons	20,736	20,641	12,800	12,947
Rum, gallons	1,062,256	58,283	180,614	301,355
Molasses, gallons	24,698	3,398	31,394	16,717
Cattle-food (Molascuit) tons	510	132	175	458
Cacao, cwts.	13	None	None	None
Citrate of Lime, cwts.	23	None	None	None
Lime Juice, gals.	418	985	None	None
Essential Oil of Limes, gals.	28	None	None	None
Coconuts, thousands	854	532	531	305
Coconut Oil, gals.	5,812	7,813	7,433	6,908
Copra, cwts.	447	1,028	5,237	4,159
Coffee, cwts.	1,839	2,311	2,290	1,779
Kola-nuts, cwts.	1	None	None	None
Rice, tons	3,533	2,082	1,239	2,324
Ricemeal, tons	16	None	None	None
Cattle, head	87	216	81	283
Hides, No.	1,305	1,503	2,501	3,119
Pigs, No.	91	63	122	361
Sheep, head	5	11	1	None
Balata, cwts.	2,236	2,364	3,670	2,887
Charcoal, bags	12,465	9,810	10,486	7,981
Firewood, Wallaba, etc., tons	1,969	2,452	1,996	1,901
Gums, lbs.	1,558	900	None	None
Lumber, ft	50,500	40,150	52,785	13,695
Railway sleepers, No	4,010	931	4,790	20,613
Rubber, cwts.	40	None	3	None
Shingles, thousands	502	72	157	299
Timber, cub. ft.	25,433	47,327	48,204	49,604

JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XVIII. JULY, 1925. No. 3

MEETING OF THE BOARD OF AGRICULTURE.

A meeting of the Board of Agriculture was held in the Court of Policy Hall on Thursday, the 18th of June, 1925. The Hon. Sir John Harrison, C.M.G., (Director of Science and Agriculture), Chairman, presided and there were present Hon. G. D. Bayley, C.B.E., Hon. J. J. Da Silva, Messrs W. Francis (Assistant Director of Science and Agriculture), R. Ward, M.M.E. (Superintendent of Botanic Gardens and Agricultural Stations), Dr. C. L. Whittles (Superintendent of Sugar Planters' Experiment Stations), Chas. Shankland (Director of Co-operative Societies), S. H. Bayley, H. L. Humphreys, Thomas Earle, C. R. Williams, H. A. Britton, with E. M. Peterkin, Secretary. Mr. R. A. Alston (Assistant Botanist and Mycologist) was also present.

The Chairman explained that the meeting which should have been held in May was unavoidably postponed on account of His Excellency the Governor being too busy, prior to his leaving the Colony, to preside. His Excellency the Officer Administering the Government being unable to attend to day, he would have to preside.

He also tendered excuses on behalf of the Honourable W. M. B. Shields, R. Strang, Esq., and Captain E.

Beckett, F.L.S., Deputy Director of Agriculture in Essequebo.

The Chairman reported that leave of absence had been granted to the following:—

The Honourable R. E. Brassington, Mr. E. M. Walcott, F.R., Dr. F. T. Wills, Mr. G. E. Anderson (Representative of the Royal Agricultural and Commercial Society).

The minutes of the previous meeting held on February 3rd., 1925, having been circulated to the Members of the Board, and having received their approval, were on the motion of the Chairman, seconded by Mr. H. L. Humphrys, taken as read and confirmed.

The Chairman stated that the following amendment to the regulation relating to traffic in the Botanic Gardens when the Militia Band performed there had been found necessary, it had been approved of by the Executive Committee, circulated and approved of by the members of the Board and would now be read for confirmation.

1. On occasions when the Militia Band plays in the Botanic Gardens, driving carriages and motor cars from East to West along the main road west of the oval is prohibited. Carriages and motor cars travelling westward at such times, must proceed by one of the outer serpentine roads.

On such occasions the riding of cycles of all kinds along the main road west of the oval, is prohibited. Cyclists must travel by the serpentine roads.

The following were laid:—

A comparative table of rates of wages at Botanic Gardens, British Guiana and Trinidad showing that higher wages were paid in British Guiana.

Acreage in principal varieties of Sugar Cane under cultivation in British Guiana during 1924.

Report on the County of Essequebo, Live Stock, Agricultural and Industrial Show, 1925, by Captain Beckett, F.L.S.

Agricultural Census returns for 1924.

The Chairman pointed out the great difficulty in obtaining accurate returns from farmers which seemed to become worse every year. He was convinced that the 1924 returns, particularly the rice, were not reliable. Mr. Shankland suggested that as there was a very great demand for seed padi, the growing of seed padi (for distribution) at Anna Regina should be considered.

The Chairman said that it was not possible to increase the acreage of rice at the Botanic Gardens as all available land had already been taken up. The seed padi they produced was on account of the great demand very quickly sold.

Journal of the Board of Agriculture, Vol. XVIII. Nos 1 and 2.

Imperial College of Tropical Agriculture Prospectus for 1925—1926.

Report on the Chlorosis of Sugar Cane by the Government Mycologist.

The necessity of examination before landing, by the Government Veterinary Surgeon, of horses imported into the Colony for short periods to fill racing engagements was next considered.

The Chairman mentioned that there were occasions on which these horses were detained on board long after their arrival, before they could be examined by the Government Veterinary Surgeon.

The Acting Government Veterinary Surgeon thought it was detrimental to the horses which should be landed as soon as possible. He was also of the opinion that such horses could be safely landed provided that they were accompanied by a certificate of health issued by the Official Veterinary Surgeon of the Colony from which they came.

The Chairman moved, seconded by Mr. S. H. Bayley that horses imported for racing purposes could be landed on producing to the Customs authorities a certificate of good health issued within fourteen days of the horse's arrival in the Colony by the Official Veterinary Surgeon of the port from which the horse came. This was unanimously carried.

An application from Mr. H. E. Reiss for the refund of the purchase price of a foal of Waterbass, purchased at Auction, said to be suffering from Kentucky disease, was discussed.

The Chairman informed the Board that Waterbass had been examined time after time and never found to be suffering from Osteoporosis. This was a disease which was not hereditary but was caused by the absence of certain constituents from the food given the animal.

He moved, seconded by Mr. G. D. Bayley, that Mr. Reiss be informed that they were unable to accede to his request.

This was unanimously carried.

Motions by Mr. H. Aaron Britton, President, British Guiana Farmers' Conference.

1. That the Grant-in-aid for Shows be doubled.

2. That there should be bi-annual Shows by every Association affiliated to the Board.

4. That Farmers' Competitions be held on lines analogous to Shows.

These were seconded by the Hon. J. J. Da Silva for the purpose of discussion. After some discussion, Mr. Britton withdrew these motions on the understanding that they would be considered by the Agricultural Exhibitions Committee of the Board.

3. That a Grant-in-aid be obtained in favour of Beterverwagting--Triumph Association for the purpose of a Show towards the end of the year and for this the Board should take steps to secure an additional vote from the Combined Court.

This was seconded by Mr. C. Shankland. The Chairman pointed out that this district was part of the Buxton District. Shows were not given to represent a solitary village but the entire District.

Mr. Britton urged that an exception be made in this case.

The Chairman put the motion to the vote and it was lost.

Messrs. H. A. Britton, C. Shankland, C. R. Williams and J. J. Da Silva voted, for and

Messrs. W. Francis, H. L. Humphrys, G. D. Bayley, S. H. Bayley and R. Ward, against.

Mr. Shankland suggested that this motion be also considered by the Agricultural Exhibitions Committee.

5. Whereas the Mayor and Town Council of Georgetown levies and collects a fee of 6 cents per bag upon all agricultural produce landed at the Colonial Steamer Stelling and at the Railway terminus, not being produce consigned to an Agent occupying a shop or store or other premises situate in the City;

And whereas such levy is in consequence collected entirely from the small grower or peasant proprietor, and thereby creates a hardship by placing him at a disadvantage in comparison with the more prosperous farmers who are in a position to afford the services of an Agent in Georgetown for the purpose of disposing of their crops;

Be it resolved:—That this Board take such steps as may be necessary to obtain a removal of this impost in the interest of the small farmers.

This was seconded by Mr. S. H. Bayley who strongly supported it; Mr. Shankland also spoke in its favour.

The Chairman suggested that this was a matter that should be taken direct to the Town Council by the British Guiana Farmers' Conference.

Mr. Britton pleaded for the support of the Board.

Mr. G. D. Bayley was very strongly opposed to the Board's interference in this matter.

After discussion it was moved by Mr. S. H. Bayley seconded by Mr. H. Aaron Britton, that a small Committee consisting of Messrs. S. H. Bayley, C. Shankland, the Honourable J. J. Da Silva and H. A. Britton be appointed to consult with the Town Council in this matter.

6. Whereas it is desirable that for the expansion of Agriculture and the greater supervision of the work of District Agricultural Instructors and for Officers from Headquarters getting in more frequent touch with farmers, the Department of Science and Agriculture should be given proper means therefor.

Be it Resolved:—That the Government be requested to introduce in the Combined Court a motion sanctioning expenditure for the acquiring of a motor car for the Department.

The Chairman pointed out that this was purely a departmental matter. The trouble experienced by his officers was not so much getting to the District but getting aback to the farms when they arrived there.

Mr. Britton thereupon withdrew his motion.

7. Whereas it is desirable that every encouragement should be given to the people of the West Coast to engage in agricultural pursuits;

And Whereas the Government only tangible evidence of a desire to settle people on the land is by placing well drained land at the disposal of the people:

Be it Resolved:—That this Board recommends to Government the advisability of immediately acquiring Plns. Vergenoegen and Klien, Ponderoyen.

The Chairman suggested that an important motion of this kind should be considered before a full Board and not to-day when so many members were unavoidably absent.

Mr. Britton thereon postponed his motion.

8. Be it Resolved:—That the Board recommends to the Government the placing on the Supplementary Estimate a sum of not less than $5,000 for an Agricultural Live Stock and Industrial Show to be held on a date to correspond with the proposed visit to the Colony of the Secretary of State or, in the alternative during the tourist seasons of 1926.

This was seconded by Mr. Shankland but Mr. Britton withdrew it on the understanding it be considered by the Agricultural Exhibitions Committee.

The Chairman then adjourned the meeting to a date in September to be fixed later.

RESUME OF MINUTES OF MEETINGS OF THE BRITISH GUIANA SUGAR PLANTERS' EXPERIMENT STATIONS COMMITTEE FROM OCTOBER 1923 TO JUNE 1925.

The regular publication in this Journal of the meetings of the British Guiana Sugar Planters' Experiment Stations Committee recently has been inadvertently omitted. They are brought up to-date in this issue and are to be published regularly in the future. [Editor]

The Committee met on the 1st October, 1923, when the following were present:—Sir John Harrison, Chairman, Messrs. R. Strang, W. M. B. Shields, H. Deverill, R. P. Daggett and M. B. G. Austin with the Superintendent and the Secretary. The Chairman reported that Professor Went who had recently visited Sophia Station had noticed what in his opinion was Mosaic disease amongst some of the cane. The Superintendent was ordered to report any signs of disease to the Government Mycologist. The Superintendent stated in reply to an enquiry from the Chairman as to whether anything had been done in connection with the growing of varieties for sending to the British Empire Exhibition, that he was varnishing specimens of canes to send. It was agreed to accept the offer of Messrs. Curtis Campbell & Co., to purchase certain Laboratory apparatus, etc., for use in the Station's soil Laboratory, the selection being left to the Superintendent, the cost not to exceed £50.

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An inspection of Sophia Station was made on the 15th October, 1923, those present being Sir John Harrison, Chairman, Messrs. R. B. Brassington, W. M. B. Shields, H. Deverill, A. E. Craig, R. Strang, R. P. Daggett, members of the Committee; also Messrs Jas. Smith, J. C. Gibson, J. Lynch King, and W. Francis, with the Superintendent, Botanic Gardens, the Government Economic Biologist, the Government Mycologist, the Superintendent, Field Manager and Secretary.

The entire cultivation was inspected after which a meeting was held in the Manager's office. It was unanimously agreed on the suggestion of the Chairman that in view of the alleged presence of disease at the Station, the cultivation, as far as the control of disease, be under the Government Mycologist who shall have the power to destroy or remove any diseased canes. Mr. Strang mentioned that certain fields at Plantation Uitvlugt under 1st ratoons of Jamaica seedlings were badly attacked by Root-disease. The Chairman recommended that they be destroyed and some other variety planted which was not so susceptible to the Root-disease. At the conclusion of the meeting, the following remarks were written in the Visitors' book:—"The Planters visiting the Experiment "Station this day desire to record their appreciation and "satisfaction as to the general appearance of the "Station."

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Meetings of the Committee were held on the 19th November, 1923, 10th December, 1923 and 7th January, 1924, at which routine matters relative to the reports of the Superintendent and Field Manager were discussed. Owing to continued ill-health the Superintendent, Mr. Crabtree, was granted permission to terminate his contract as from January, 1924. The Secretary was granted 3 weeks leave of absence to go to Barbados, Mr J. A. V. Bourne being appointed to act in his place.

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At a meeting held on the 25th February, 1924, all the members were present with the Field Manager and the acting Secretary. The report of the Auditors was satisfactory. The Chairman notified the Committee that he had received a letter from Dr. Arthur Rosenfeld, the Special Technologist for cane, Porto Rico, dealing with some cuttings he was sending to identify as D625. Mr. Strang said that the variety sent to Porto Rico from Plantation Uitvlugt, was "419" and that he understood that they were getting very good results there from this cane. The Comittee approved of some cuttings of its promising varieties being sent to Porto Rico, and that Dr. Rosenfeld be asked for co-operation in getting for us some of the Porto Rico parasites of the Moth Borer for introduction at Sophia. It was agreed to write Sir Daniel Hall, Chief Scientific Adviser to the British Board of Agriculture regarding a successor to Mr Crabtree.

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A visit of inspection to Sophia Station was paid by the Committee and other sugar planters on the 17th March, 1924, the following being present:—Sir John Harrison, Chairman, Messrs. R. E. Brassington, A. E. Craig, G. E. Anderson, D. Clarke, members of the Committee, also Messrs. Jas. Smith, R. P. Daggett, R. E. Rhodes, W. Speed, L. Lywood, H. A. Barclay, R. B. Hunter, G. E. Mackintosh, T. Mingo, C. Sanchelot, and W. Francis, with the Superintendent, Botanic Gardens, the Government Economic Biologist, the Government Veterinary Surgeon, the Field Manager and the Secretary. The following remarks were written in the Visitors' Book at the conclusion of the inspection:—"The Planters visiting the Station desire to record their great satisfaction with the general condition of the cultivation and appreciation of the work being carried on by the staff under Sir John Harrison, C.M.G. and express the hope that at no distant date a seedling will be raised superior in every respect to the famous "D625."

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A meeting was held on the 31st March, 1924, at which all the members were present with the Field Manager and the Secretary. Mr. P. H. Edwards was appointed to act in place of Mr. D. Clarke and Mr. C. Farrar in place of Mr. W. M. B. Shields who would shortly be leaving the Colony. Correspondence from Sir Arthur Shipley and Professor T. B. Wood of Cambridge University relative to filling the post of Superintendent was read and considered. It was decided to offer the post to Dr. C. L. Whittles who had been highly recommended and that Sir Edward Davson be asked to arrange an interview with him, the appointment being subject to Sir Edward's approval. It was agreed to grant an application from the Java Experiment Station for the purchase of tops of various named varieties of canes when available. With reference to the proposed importation of parasites of the moth-borer of the sugar cane, Mr. Shields asked permission for Messrs. S. Davson & Co. to send its Entomologist to Porto Rico for the parasites. All expenses, he mentioned, would be borne by the firm. Also to establish a quarantine station at Plantation Blairmont for rearing the parasites, the station to be under the control of the Committee. The Chairman pointed out the possible danger of the introduction of such diseases as Mosaic by the introduction of insects living on pieces of sugar cane from countries such as Porto Rico in which they may be prevalent, as well as the danger underlying the importation of so-called immune sugar canes from places where such disease is prevalent, as while a variety may be immune to the effects of such disease, it by no means follows it is not a carrier thereof. He instanced the introduction in the late nineties of the "root fungus" from Barbados by cuttings of varieties said to be immune thereto. After discussion, the importation of the parasites was agreed to, provided the greatest care was exercised by the Entomologist of Messrs. S. Davson & Co., and the Government Economic Biologist in preventing the introduction of such diseases.

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At a meeting held on the 12th May, 1924, the members with the exception of Mr. Craig were present with the Field Manager and the Secretary. The usual statement of Receipts and Expenditure and the Field Manager's Report after discussion were adopted. The Chairman read a paragraph from a letter he had received from Dr. A. H. Rosenfeld of the Porto Rico Experiment Station relative to the moth-borer parasite, stating that his Entomologist states that the Cuban parasite has been very little studied there, its usefulness not demonstrated and its acquisition decidedly difficult due to a lack of knowledge of its habits and that its exportation was impracticable at the present time. Distribution of tops of the following varieties to local estates was approved:—B.H. 10(12), D.149, D.145, and D.118.

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A meeting was held on the 16th June, 1924, at which the members, with the exception of Mr. Brassington, were present with the Field Manager and the Secretary. The Statement of Receipts and Expenditure for May and the Field Manager's Report were adopted. The Chairman read a letter from Dr. Rosenfeld of Porto Rico mentioning the arrival of Mr. Box, Entomologist of Messrs. Dawson & Co., and that the latter had been collecting puparia of the parasite of the moth-borer for a trial shipment to British Guiana. Mr. Farrar mentioned that a consignment had already been received, the insects having been sent in cold storage. The Chairman notified the meeting of the acceptance by Dr. C. L. Whittles of the post of Superintendent.

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At the meeting held on the 14th July, 1924, the members, with the exception of Mr. Brassington, were present with the Field Manager and the Secretary. The Chairman read a letter from Messrs Curtis Campbell & Co., approving of the extension of the lease of the Sophia station for five years. Mr. Strang mentioned that canes at Plantation Uitvlugt had been attacked by a disease identified by the Government Mycologist as "Top-Rot". The

Field Manager mentioned that a few stools at Sophia had been found to be similarly diseased. Some discussion as to the prevalence of the moth-borer ensued. The Chairman said that he had instructed the Government Economic Biologist to enquire into the habitats of the borer other than the sugar cane. The Chairman informed the meeting that a collection of sugar cane cuttings had been sent to Java. Sick leave to the end of the month was granted to the Overseer.

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A visit of inspection to Sophia Station was paid by the Committee on the 11th August, 1924, the following being present:—Sir John Harrison, Chairman, Messrs G. E. Anderson, A. E. Craig, P. H. Edwards, members of the Committee; also Messrs R. P. Daggett, L. Lywood, R. E. Rhodes, A. Waterfield, F. Gilchrist and C. W. B. Arnold with the Government Economic Biologist, the Government Mycologist, the Field Manager and the Secretary. The following remarks were entered in the Visitors' Book:—"Members of the Committee and others invited to inspect the Station all express their approval of the work which has been carried on since the last official inspection. It is most unfortunate that heavy rains prevented a full attendance of members and others interested in the work of the Sophia Station."

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At the meeting held on the 8th September, 1924, the members, with the exception of Mr. A. E. Craig were present with the recently arrived Superintendent, the Field Manager, and the Secretary. The Government Mycologist also attended. The Chairman introduced the Superintendent, Dr. C. L. Whittles, B.A., and those present welcomed him and assured him of the co-operation of the Sugar Planters in the Colony. The estimates for 1924-1925 were considered; and it was agreed to appoint Mr. A. D. E. Lauchlan, B.A., of St. Catherine's College as Assistant Chemist, on the recommendation of

Dr. Whittles, at a salary of £500 to £600. After discussion of other items of expenditure the estimates were carried out at $29,000. It was unanimously decided to recommend the Planters' Association to fix the rate of assessment at forty cents per acre.

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A meeting of the Committee was held on the 14th October, 1924, at which all the members were present with the Superintendent and the Secretary. Mr. E. M. Peterkin, Secretary, Board of Agriculture, also attended. The Chairman notified the Committee that the rate of Assessment, viz., forty cents per acre, had been approved by the Planters' Association. The monthly statement of Receipts and Expenditure and the Field Manager's Report were adopted. Authority was granted the Superintendent to purchase apparatus necessary for work on soils. He also recommended the purchase of a Simar Rototiller for the Station. Mr. Strang informed the Committee that his firm had one on order and suggested that the Committee should see the work it did before ordering another. This was agreed to. The Superintendent asked permission to try some experiments at Sophia with the "Assam System" of drainage. This would necessitate expenditure not provided for on the estimates. Messrs Strang, Anderson, Craig and Edwards each offered to place five acres at the Superintendent's disposal for conducting the experiments on their respective estates if he would visit them and show how the drains were to be dug. The digging of some specimen drains at Sophia was authorised. It was decided to circulate Mr. Box's report on his visit to Porto Rico among the members. The Chairman stated that a circular letter drawing attention to the alleged occurrence of Mosaic disease had been sent out from Sophia without his knowledge or sanction. The local history of the varieties alleged to be infected (Nos. B.H 10 (12) and Ba 6032) was detailed. The Superintendent impressed on the meeting his view that the whole of the Sugar canes of these varieties under cultivation in the Colony should be at once destroyed. The Chairman recorded his dissent from this advice as in his opinion the chlorosis noticed by Dr. Whittles and Mr. Altson differed very materially from the Mosaic chlorosis he had inspected in Barbados in 1921, under the guidance of Mr. J. R. Bovell, Direcor of Agriculture.

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A meeting of the Committee was held on the 17th November, 1924, the following being present:—Sir John Harrison, Chairman, Messrs R. Strang, A. E. Craig and G. E. Anderson with the Superintendent and the Secretary. Mr. Strang mentioned in connection with the Rototiller that his firm's engineer had reported it was not suitable for this Colony but that he, Mr. Strang, had ordered one in spite of this, and on arrival in the Colony, he would lend it to Dr. Whittles for trial at the Experiment Station. In connection with the reported appearance of Mosaic disease at Sophia, the Chairman showed the Committee specimens of cane leaves which had been sent by the Director of Agriculture, Barbados, at the former's request. The leaves were from the varieties B.H 10(12), Ba 6032 and Ba 11569 and taken from healthy plants and from plants attacked by Mosaic respectively. He assured the meeting there was no cause for alarm as neither he nor the staff at the Botanic Gardens had seen any leaves of varieties in the Colony with markings similar to those on the cane leaves from Barbados He proposed sending the specimens to the next meeting of the Planters' Association for the Planters to see what the markings of Mosaic were like. The appointment of Miss M. Sealy as Clerical Assistant was approved.

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A meeting of the Committee was held on the 8th December, 1924, the Chairman, Messrs A. E. Craig, G. E. Anderson and D. Clarke being present with the Superintendent, the Assistant Chemist and the Secretary. It was decided to resume the work of raising the seedlings on the Botanic Gardens land as done prior to 1922-23 and not at Sophia. An offer from Mr. Camisuli to purchase at 20 cents per gallon syrup obtained by the evaporation of the samples of cane juice was not entertained. Typical leaves of the sugar cane B.H. 10(12) affected by Mosaic received from Mr. J. R. Bovell, Director of Agriculture, Barbados, were compared with leaves of the same cane grown at the Botanic Gardens and affected by chlorosis. The members noted the differences were striking. At the request of the Superintendent, it was decided to submit leaves of the sugar cane B.H. 10(12), which he, the Superintendent, considered to be affected with Mosaic to Mr J. R. Bovell for critical expert examination.

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The Committee met on the 12th January, 1925, when all the members were present with the Superintendent and the Secretary. The Committee appointed Mr. R. Thomson to act as Field Manager during the absence through illness of Mr. Bastiaans. Mr. E. S. A. Chin was appointed Chemist's Assistant on probation vice Mr. Mc Lean, who would resign at the end of the month. Mr. Brassington reported an outbreak of "froghopper" at Hampton Court and the Chairman promised that the services of the Government Economic Biologist would be placed at his disposal to investigate the matter. The following motion, moved by Mr. Brassington and seconded by Mr. Craig was passed unanimously:—"In view of the price of sugar having fallen below the cost of production and the present outlook for improvement in this being far from hopeful, it is necessary for every feasible economy to be exercised in connection with the work of the Sugar Planters' Experiment Station. The Superintendent and the Field Manager are to exercise the strictest economy in connection with the working of the Sophia Station."

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A meeting was held on the 16th February, when all the members were present with the Superintendent and the Secretary. Extension of leave of absence to Mr. Bastiaans to the 31st March was granted. Mr. Chin was confirmed in his appointment as Chemist's Assistant. The statement of Receipts and Expenditure was next considered, the Chairman drawing attention that the expenditure to date was $5,000 less than for the same period last year. Mr. Strang having mentioned that he had been informed that the Rototiller had arrived, it was agreed that a trial should be made when the members would attend. A letter from Mr. E. E. Sill asking permission to import 5,000 plants of the Uba Cane was read; the Committee decided against such importation in view of the possibility of Mosaic or other diseases of cane being introduced into the Colony. It was decided to offer Mr. Sill some tops of the Uba cane from Sophia free of charge. The Chairman laid before the meeting Mr. J. R. Bovell's report on the examination of the leaves of sugar cane affected with chlorosis forwarded to him for examination in accordance with the decision of the meeting of 8th December, 1924. The salient parts of the letter were as follows:—"I have to acknowledge the receipt of your letter No. 16/211/24, dated January 6th, informing me that you were sending me by the mail steamer a box containing two bottles, one with the leaves of B.H. 10 (12) from the Experimental fields of the Botanic Gardens affected by chlorosis (Dr. Whittles' mosaic), the other with leaves from the same cane taken from a place where no appearance of chlorosis has arisen, and asking me to give you my opinion as to whether I consider that Dr. Whittles is correct in stating that this chlorosis is mosaic chlorosis, or whether in the opinions of the rest of your staff and yourself that it is not the true mosaic chlorosis is correct.

"In reply, I beg to inform you that Mr. C. C. Skeete, the Assistant Director, Mr. H. O. Ramsay, who has been Inspector under the Mosaic Disease (Eradication) Act during the seasons January to May, 1922; December, 1922 to May, 1923; November, 1923 to May, 1924, and is Inspector again this year, and has had a great deal of experience in deciding whether sugar canes, Indian and Guinea corn are attacked by Mosaic disease chlorosis, as well as Mr. C. B. Foster, the First Field Assistant, and myself have carefully examined the specimens, and are of the opinion that the specimens you have sent me are not attacked by mosaic disease chlorosis."

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A meeting was held on the 23rd March, 1925, when the following were present:—Sir John Harrison, Chairman, Messrs W. M. B. Shields, D. Clarke and G. E. Anderson with the Superintendent and the Secretary. A statement by the acting Field Manager showing in detail the areas under the various seedlings at Sophia was laid. It was decided that only specimens of Demerara varieties of canes be sent to Wembley. With regard to the question of the Sugar exhibit for the Exhibition the following motion, moved by Mr. Anderson and seconded by Mr. Shields was carried unanimously. "That the local Exhibition authorities be approached with the view of pointing out to them that the pyramid of sugar of the last Exhibition was left unprotected from the atmosphere and dust, and so deteriorated during the Exhibition (except on those occasions when the sugar was replaced) that its condition was calculated to do great harm to the sugar industry of the Colony, and in order to prevent a repetition of the above, it is suggested that the sugar of the pyramid be covered with glass."

The Committee recommended that Demerara crystals be forwarded in model hogsheads each containing about one hundred weight, the packages to be lined with moisture proof paper which would be supplied by Mr. Shields. The upper part of the packages should also be lined with blue paper to set off the colour and bloom of the Demerara crystals. Mr. Anderson promised to have the packages made at Plantation Diamond and the Secretary was instructed to ascertain whether the Exhibition funds could meet the cost of these. The report of the Superintendent on the visit of himself and staff to the Essequebo Agricultural Show was discussed. Mr. Anderson suggested that as much interest had been displayed by the farmers at the Superintendent's demonstration, it might be advisable for the latter to give a course of demonstrations to overseers at various centres. The Committee considered the suggestion a commendable one and the Superintendent was asked to make a draft of a scheme for carrying out these lectures. The Chairman reminded the Committee it was indebted to Mr. J. R. Bovell, Director of Agriculture, Barbados, for having assisted them in deciding that the chlorosis on the B.H. 10(12) was not due to Mosaic disease. Mr. Anderson mentoned that this variety was doing exceptionally well at Plantation Diamond, its juice being of a very high quality. The Committee unanimously passed a vote of thanks to Mr. Bovell for his kind assistance and asked the Chairman to write Mr. Bovell in terms of the above. Mr. Anderson mentioned the prevalence of Castnia at Plantation Diamond. He had tried a preparation (boll weevil exterminator) which he thought was effective in killing the grubs. The Chairman promised to draw Mr. Cleare's attention to the matter. Mr. Shields informed the Committee that the Rototiller for Messrs. S. Davson & Co. had arrived at Plantation Blairmont and would be tried as soon as possible. Leave of absence on full salary for six months was granted to the Secretary and Mr. J. A. V. Bourne was appointed to act for him on half pay.

At a meeting held at Plu. Sophia on the 21st April, 1925, all the members were present with the Superintendent and the acting Secretary. The resumption of duty by the Field Manager was reported. The draft of the Annual Report for 1924 which had been circulated to the members was referred to the Chairman and Superintendent for necessary elaboration. The Chairman reported that an 8 H.P. Crossley engine had been purchased from the Public Works Department and installed by it at the Experimental Fields Laboratory. The expenditure was approved and a vote of thanks passed to the Director of Public Works and to Commander Parez for supplying and installing the engine. Leave of absence having been granted to Mr. Anderson, Mr Daggett of Plantation Providence was appointed to act during his absence from the Colony.

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A meeting was held on the 8th June when the following members were present: Sir John Harrison, Chairman, Messrs R. E. Brassington, W. M. B. Shields, D. Clarke, G. E. Craig, R. P. Daggett with the Superintendent and the acting Secretary. The purchase of a model mill from Messrs. Sandbach Parker & Co. was approved.

It was decided that in future fields thrown out of cultivation should be broadcasted with legumes etc, as a green manure. Mr. Brassington was granted leave during his absence from the Colony and Mr. W. S. Jones was appointed to act for him.

BIRDS AS FRIENDS.

This is experience of birds as insect destroyers in the United States. Tens of millions of dollars are spent annually in fighting insect pests. Everywhere we hear of the encroachment of devastating insect hordes; the boll weevil, the potato bug and grasshopper, invasions of moths, caterpillars, beetles, cutworms, cankerworms, Hessian flies, fruit flies and plant lice. On every hand men are fighting the inroads of these pests with spraying apparatus, with torches, nets and fumigating appliances, with poison pastes and powders. Crews of men are busily engaged in cutting and burning areas of bug trees in our forests. Still, that appalling annual loss of more than $1,000,000,000 attributable to insect pests go on.

A single robin requires from eight to eleven ounces of insect food a day to keep life in its body—approximately its own weight. A pair of nesting robins then will consume not less than a pound of insects a day or 210 pounds during the seven months they remain in the breeding grounds. This is exclusive of the insects consumed by the two broods of young birds they will rear during the nesting season.

I quote from works of Dr. W. T. Hornaday, bulletins of the Biological Survey and from other sources a few proved facts as to insect destruction by various birds.

A quail has been known to consume 84 grasshoppers 100 chinch bugs, 568 mosquitos and 24 other insects in three hours! At other single meals 1,350 flies and 1,286 rose slugs were consumed.

Meadow larks, orioles, swallows, flycatchers, warblers, woodpeckers and hundreds of other birds, all voracious eaters, can boast of an insect diet ranging from 65 to 95 per cent. of their total food requirements.

The stomach of two pine siskins contained 1,900 black olive scales and 300 plantlice. One night hawk ate 340 grasshoppers and 58 other bugs at a meal; and so on indefinitely. Consider, then, that there are not less than 150 pairs of nesting birds to the average section of cultivated land and the enormous poundage of insects and larvæ consumed by them daily. This feathered army is always on the hunt, some on the ground and some of the long-billed varieties prospecting beneath the ground; others in the bushes, hunting in the trees, examining every leaf and bit of bark; still others on the hunt in the air above. Without the assistance of these feathered hosts the agriculturists would be helpless.

The birds of any farm or orchard consume more insects in a single day than a man could destroy with all his sprays, torches, smudges, and so on, in a week of hard labour. Without them, in fact, he would be put out of business, since the insect hordes would make agriculture impossible.

This has been proved by actual instances within the last two decades. The birds were shot out of certain districts in New South Wales and the land that had been won over from the bush and put in crops was entirely devastated by insects within a few years after the disappearance of the birds. The settlers entirely deserted one area of thirty square miles. So it appears that the conservation of song birds, too is a matter of sound economic importance and not a matter of mere sentiment.—*The Saturday Evening Post.*

DETERIORATION OF CANE AFTER CUTTING.

Numerous investigations have been made in sugar producing countries on the losses resulting from delay in handling cane after cutting. These results have been given in general terms and as a rule comparative data have not been presented. Tests have recently been made in the Philippines to determine the definite facts with the accompanying losses in sugar in the time elapsing between the starting of the harvesting and the milling of the cane.

These tests were planned by H. Atherton Lee and conducted by F. M. Clara under the auspices of the Philippine Bureau of Agriculture and presented in the January issue of "Sugar News." The object of the test was to measure the losses in actual sugar definitely and to present in a positive manner the amount of these losses during the interval lapsing between the first operation in harvesting and the actual milling of the cane. A field of cane was selected and divided into ninety plots. These ninety were subdivided into three general experiments. The first investigation was to determine the loss from topping cane and allowing intervals to elapse between the topping and cutting and milling of the cane. In this experiment every third plot was topped; that is, cane was not cut, but the points for seed were cut off and the cane allowed to stand in this condition. The result of this investigation was that the complete harvesting of the cane and milling on the same day showed a polarization of 16.74 per cent., with a purity of 89.1 per cent. Allowing the same cane to stand one day after topping and then cutting and loading the polarization was found to be 15.8 per cent., with a purity of 84.1 per cent. ; cane cut and loaded three days after topping showed a polarization of 15.28 per cent. and a purity of 80.4 per cent., and cane cut and loaded four days after topping showed a polarization of 13.91 per cent. and a purity of 73.2 per cent. From these results there is a gradual drop in the purity of the juice from the cane and in the sugar content or polarization depending upon the period of time elapsing between the topping and the cutting and milling, showing a fall in purity of five points in purity on the first day and also .94 per cent. in polarization. After three days the fall in purity was 8.7 and the decrease in polarization 1.46 per cent. and after four days the fall in purity was 15.9 and the fall in polarization 2.29 per cent., showing very marked deterioration and loss of sugar from cane standing in the field after having been topped. The second experiment determining the losses from cutting cane and allowing the cane to lie in the fields for different periods before loading and milling was conducted on the same general plan as the first experiment, with the following results: Cane cut and loaded on the same day showed a polarization of 16.56 per cent. and a purity of 89. Cane cut and loaded one day after cutting showed a polarization of 15.2 per cent. and purity of 81.8, cane loaded three days after cutting gave a polarization of 14.78 per cent. and a purity of 77 cane loaded four days after cutting gave a polarization of 13.80 per cent. and a purity of 71.1, cane loaded five days after cutting gave a polarization of 14.53 per cent. and a purity of 74.9, and cane loaded seven days after cutting gave a polarization of 13.68 per cent. and a purity of 68.7 per cent. These investigations show marked losses in sugar content and purity in allowing the cane to lie in the field for the different periods mentioned and the care exercised in conducting these experiments give us valuable data as to the losses incurred by the delay in loading and delivering to the mill after cutting in the fields. The loss on the first day was 1.36 per cent. of polarization and 7.2 in purity, after three days the loss was 1.78 per cent. in polarization and 12 points in purity, on the fourth day after harvesting the loss in polarization was 2.76 per cent. and in purity 17.9 points, with five days elapsing between the cutting and loading we find a slight exception to the general loss which is not frequently encountered in experiments of this nature and should be eliminated from the record. With seven days elapsing the losses were, as to be expected, the greatest. We find a loss in polarization of 2.88 per cent. and in purity of 20.3 points. From this it is apparent that there are large losses in sugar from allowing cane to lie in the field after cutting and this emphasizes the necessity of expediting the handling of cane during harvesting period and presents to our attention in a positive manner the money losses from the delay in the milling of cane after cutting. Investigations were conducted further showing the effect of shading the cane at a loading station immediately after cutting. The losses of sugar in the cane were much less than from the topped cane standing in the field or from the cut cane lying in the field under conditions in the Philippines which are comparative in all cane sugar producing countries, and showed a marked difference in favour of the shading of cane. The difficulty, however, that would accompany such a utilization of this shade in different countries during the season of harvesting, when labour is fully occupied, and the time and labour necessary to place cane under sheds are not available, would largely govern the use or adaptability of a shaded loading station. These data present to us in a very forcible manner the necessity of despatch and rapidity in handling cane during the harvesting season and show the losses by deterioration in the field are very great if delayed. We have had previous investigations of the losses from allowing cane to stand in the cars after loading, and comparing these losses with the losses in the field we find them almost equally as great. These results before us present to us the fact that the necessity of the avoidance of delay in moving cane from fields to the cars is as equally essential as to avoid delay in transporting from the fields to the factory.—*The Louisiana Planter and Sugar Manufacturer.*

THE ABSORPTION OF ATMOSPHERIC NITROGEN BY LEGUMINOUS PLANTS.

The use of leguminous plants for the improvement of soils is a practice of long standing, and it is now established that this improvement is effected by the absorption of nitrogen from the air by the agency of bacteria in the nodules on their roots. The general facts of the process are agreed upon, but there has been much discussion concerning its details, and several points are not completely decided. There have, however, been many experiments and investigations on the problem, and a considerable amount of information is available. As several correspondents have expressed a desire to know more about the subject than the mere fact that leguminous plants do take in nitrogen from the air, the following summary has been compiled.

The bacteria obtain entrance into the roots of the plant through a root-hair. Their presence within the plant causes a rapid cell division, so that a swelling or nodule is formed. This is analogous to the formation of galls as a result of an insect puncture or the attack of a fungus. The central portion of the nodule consists of parenchyma, while the outer layers are the same as the cortex of the root. The central tissue contains the bacteria. With the bacteria there occur other bodies which are known as bacteroids. The bacteria are rod-shaped, but the bacteroids are irregularly swollen and sometimes forked or Y-shaped. The latter are regarded as degenerated or involution forms of the bacteria; they are frequent in the nodules, but in artificial cultures they do not occur until the culture is old.

The nodules are most abundant and largest when the plants are growing in well-aerated soil. In saturated soils they occur at the surface. They will form on the roots of plants grown in water culture, but are not then as large or as active as in aerated soil. In dry soil they are much less numerous than in moist soil, but excessive quantities of water are injurious. One might summarise this by the statement,—the more root-hairs, the greater the chance of nodules.

It is believed that nitrates inhibit nodule formation. It is thought by some that the addition of soluble nitrates to the soil decreases the formation of nodules and the same has been claimed for sulphates and ammonium salts. Legumes growing on a soil rich in nitrates may be immune to the nodule bacteria, and prevent their entrance into the roots, but small quantities of nitrates act as a stimulant.

When the plant produces seeds, the interior of the nodule decomposes, leaving the tougher outer cortex as a mere shell, which subsequntly decays. This process, however, has only been determined in the case of plants which die after producing seeds, and it is not known to what extent it is applicable to tree forms, such as the Dadap and Albizzia.

As the formation of a nodule is the result of an infection by a particular bacterium, nodules can only be produced in soils in which these bacteria are present. Most soils do contain them, though in varying quantity. It sometimes happens that the first crop of a leguminous plant on a given soil may be poor owing to the comparative scarcity of the bacteria, while succeeding crops of the same plant improve owing to the increase in the number of bacteria through the growth of the host plant. The bacteria may be carried on the seed, or may be disseminated by wind or water.

The question now arises whether the nodules on all leguminous plants are caused by the same bacterium, or whether different species or groups of plants require different bacteria. This is a much disputed question, and complete agreement has not yet been reached. It has been found that, in some districts, some leguminous plants could not be grown successfully when first introduced, until soil in which the plant had grown was imported for inoculation. That has happened in the case of lucerne and of soy bean. Again, where clover would not grow, success has been obtained by scattering clover chaff or straw over the land. Such examples point to the existence of different bacteria for different plants.

Numerous experiments have, however, shown that one species of bacterium can undoubtedly cause the production of nodules on many species of plants. Some claim that there is only one species which causes nodules on leguminous plants, but that it includes strains or races, each of which is accustomed to a particular group of plants. A recent classification divides these strains or species into eleven groups, those of each group being interchangeable with one another. Thus the bacteria found in the nodules of the various species of Clover (*Trifolium*) are interchangeable; those of Sweet Clover (*Melitotus*) will infect Lucerne and other species of *Medicago*; the Cow-pea bacteria will infect the ground-nut, Desmodiums and Acacias; those of the garden Pea (*Pisum*) infect the Sweet Pea (*Lathyrus*) and the Broad Bean (*Vicia*), but not the French Bean (*Phaseolus*); the Soy bean bacteria have for a long time been supposed incapable of producing nodules on other plants, but one experimenter claims to have successfully inoculated soy bean with bacteria from lucerne.

Leguminous plants are common in the Tropics, and it is most probable that all strains or species of their nodule-forming bacteria are represented there. Ceylon experience would favour that view, as no difficulty has been met with in establishing the numerous green manure plants which have been introduced.

It has long been known that, where the ground is poor in these bacteria, they can be introduced by scattering soil in which the desired plant has previously grown. The suggestion is immediately obvious, that more certain results would be secured by cultivating the bacteria by the usual methods in the laboratory and distributing the bacteria, preferably by inoculating the seeds, *i. e.* by immersing the seeds in water containing the bacteria. That was first tried in Germany by Nobbe and Hiltner, who distributed cultures on gelatine under the name of Nitragin, but on the whole these attempts were unsuccessful. Similar attempts were subsequently made by Moore in America, with a like result. More recently, Bottomley, in England, issued preparations of the bacteria, under the name Nitrobacterine, and Stead's boom of this will no doubt be within the recollection of our readers. Marvellous results were claimed from the use of Nitrobacterine, but it was conclusively shown that the bacteria did not survive distribution. At the present day these methods of distribution are discredited.

The methods of soil inoculation are, however, in use and are recognised as superior to the use of commercial cultures. Both these are based on the transfer of infected soil. One is simply the scattering of the infected soil over the new ground. The other is known as the glue method, and consists of first moistening the seeds with a ten per cent. solution of glue, and then sprinkling infected soil over them sufficient to absorb all the moisture.

The fact that the bacteria do absorb nitrogen from the air having been established, the problems arose, how they did it, and how the nitrogen was conveyed into the plant. And parallel with these are the questions,—Is all the nitrogen which is absorbed from the air taken up by the plant? Is any excreted by the nodules into the surrounding soil? If taken up by the plant, where is it stored? Are the leaves, etc., of a leguminous plant richer in nitrogen than a non-leguminous plant? It is evident that these questions touch on points which are of the greatest importance to the practical man, especially in the Tropics, where permanent tree forms are grown as green manures.

Several hypotheses have been propounded regarding the method by which the bacteria take up nitrogen from the air, but none of these has been established. As regards the absorption of the nitrogen by the plant, there are two hypotheses. One supposes that the bacteroids are absorbed by the plant fluids; the other, that the bacteroids, by some change, produce a nitrogenous substance which is absorbed by the plant. Neither of these has been proved. Consequently both the problems stated are still unsolved.

As regards the distribution of the nitrogen in the plant, several points are regarded as settled. Stocklasa, in 1895, found that, in the case of Lupins, the nodules were richest in nitrogen at the time of blooming (5.22 per cent.), and that their nitrogen content diminished as the fruits matured (to 1.73 per cent.). His results indicate that the nitrogen in the nodules is either taken up by the plant for seed production or is diffused into the soil.

Knisely analysed the different parts of lupin plants at three distinct periods of development. His results showed the following amounts of nitrogen, expressed as percentages of the dry weight:—

PERIOD	Leaves	Pods	Stems	Roots	Nodules.
Full bloom	4·02	3·07	1·15	·92	5·17
Pods well formed	3·70	3 38	.88	·83	4·29
Pods very large	3·41	3·68	.90	·66	3·70

It will be seen that as the pods mature, the percentage of nitrogen in the other parts of the plant decreases.

Exhaustive experiments on the fixation of nitrogen by Cow-peas and Soy beans have been made by Whiting. His results were published in Bull. 179, University of Illinois, Agricultural Experiment Station, from which most of the foregoing details have been taken. Whiting found that at the time of harvest about 74 per cent. of the nitrogen was in the tops, the remainder being distributed through the roots and nodules. In the earlier periods, the roots contain more than the nodules, but later this is reversed.

It has been shown by several investigators that if the plants are harvested at different stages there is an increase in the total nitrogen with each older stage, until the seeds are formed, when there is a substantial decrease. Whether this represents an actual loss has not yet been determined.

Hopkins analysed Cow-peas grown with and without bacteria. The following table gives one set of his results, the dry weight and amount of nitrogen being in centigrams.

	Parts	Dry Weight	Nitrogen percentage.	Nitrogen amount
10 plants with bacteria	Tops	3,580	4·09	146
	Roots	620	1·45	9
	Nodules	190	5.97	11
	Total	4,390	—	166
10 plants without bacteria	Tops	1,560	2·42	38
	Roots	300	·88	3
	Total	1,860	—	41

"The infected plants contained nearly four times as much nitrogen as the uninfected plants, and about three-fourths of the total nitrogen in the infected plants was obtained from the air."

We can now answer some of our questions. According to the foregoing results, leguminous plants which are furnished with nodule bacteria contain a greater percentage of nitrogen than those which lack bacteria. This nitrogen is stored principally in the tops, *i.e.*, leaves and green stems. When the plant fruits, the percentage of nitrogen in all other parts decreases.

After the plant fruits the nodules decay, and some nitrogen will then be added to the soil, but it has not been determined whether any nitrogen is excreted into the soil at other times. The practice of growing together a leguminous and a non-leguminous plant dates at least from the days of ancient Rome, and it is claimed that the non-legume benefits by the presence of the legume by obtaining nitrogen from the latter. That this occurs during the second year of its growth might be expected, but a benefit in the first season is not sufficiently established.

The amount of nitrogen added to the soil by a leguminous crop has been estimated on several occasions.

in temperate countries. A gain of 200 pounds per acre has been reported by the New Jersey Experiment Station with crimson clover. In Canada, ten years' results with clover on a light sandy loam gave a yearly gain of 50 pounds of nitrogen per acre. In the latter instance, the clover was cut and left to decay on the land. It was found that the crop contained from 100 to 150 pounds of nitrogen per acre, but that all except 50 pounds was dissipated by bacterial activities and in other natural ways.

It will have been noted that the facts which have been established concerning leguminous plants as green manures relate to herbaceous plants, and principally to annuals. Many of them will no doubt be applicable to the similar plants, e. *g*., *Crotalaria*, grown as green manures in the Tropics, but it is doubtful how far they can be applied to our permanent tree forms. Practically no investigation has been carried out on this subject under tropical conditions, and it is quite possible that such investigation might lead to a considerable modification of current practices.

It is especially of interest to note that, in the Canadian experiment referred to above, from one half to one-third of the nitrogen contained in the plant was lost in the process of decay. This illustrates one point which is in particular need of investigation in the Tropics. The amount of nitrogen added in the green manure has been estimated on many occasions, but how much of that goes to enrich the soil is another story. Under tropical conditions, the amount lost in decay is likely to be larger than in temperate climates, and it will no doubt vary with the practice followed, *i. e.*, whether the green material is dug in or whether it is left to decay on the surface. But all this awaits investigation.

Reference may be made to a few points, relating to green manures in Ceylon, which have been raised by correspondents. Some have pointed out rather indignantly that the nitrogen content of, say, dadap, stated in Bulletin X differs from that given in Bulletin Z. There are two explanations of that.

In the first place, in dealing with tree forms, the nitrogen content of the loppings will vary with the stage of growth of the loppings. Leaves contain a higher percentage of nitrogen than stems, and the soft green tissues contain a higher percentage than the wood. Consequently the younger the loppings the higher the percentage of nitrogen they will show on analysis. Old woody loppings will show a smaller percentage of nitrogen, because of the quantity of wood they contain. The only way to avoid this difficulty when comparing the nitrogen content of different plants is to have separate analyses of the leaves, green stems, and woody stems. It is to be noted that these statements refer to percentage of nitrogen, not to total quantity. The greater weight of the older loppings may involve a greater total weight of nitrogen, in spite of the smaller percentage.

A second source of discrepancies lies in the fact that, in order to give the planter some idea of the quantity of nitrogen which he is adding to the soil, the percentages of nitrogen have been based on varying standards, *i. e.*, the green weight of the plant, the sun-dried weight or the air-dried weight. All these are variables. About four-fifths of the green parts of a plant consist of water, and the green weight will vary with the weather and the time of day when cut. Similarly the sun-dried and air-dried weights will vary with the humidity and temperature of the air. To avoid these difficulties it is usual to express the weights of the various constituents of a plant as percentages of dry weight when dried at 100° C. Without that standard, the percentages are not strictly comparable.

Numerous analyses of green manure plants in Ceylon are scattered through various publications, but for the reasons given above these are not usually comparable with the analyses of plants in temperate countries. Nor can they be correlated with one another, in the absence of information concerning the relative amounts of leaf and stem, and the stage attained by the plant at the time the samples were taken.

One point revealed by these Ceylon analyses may, however, be referred to. *Indigofera aml* is said to contain 1.86 per cent. of nitrogen reckoned on the air-dried weight, and *Cajanus indicus* 1.88 per cent. on the same basis. These compare very unfavourably with the figures for Soy beans, but they are plants with somewhat woody stems and small leaves. The point, however, which is worthy of notice, is that *Passiflora foetida* contains 2.16 per cent. of nitrogen in the whole plant, and 3.81 per cent. in the leaves and fruits, reckoned on the same basis. Again, tea twigs, fresh, are said to contain 1.16 per cent. of nitrogen, while dadap loppings, fresh, contain 0.85 per cent., and *Crotalaria striata*, fresh, 0.86. These results again raise the question whether, in the tropics, the leguminous plants, in general, contain a greater percentage of nitrogen than non-legumes, and whether, apart from a possible excretion of nitrogen from the roots of the legume, manuring with any green stuff, as is practised in paddy cultivation, does not add as much nitrogen to the soil as manuring with a leguminous plant. If, however the green stuff is grown *in situ*, it has to be borne in mind that the legume obtains up to three-quarters of its nitrogen from the air, while the non-legume obtains its nitrogen from the soil.—Tropical Agriculturist LXIII Vol. 5.

THE LEACHING OF FERTILISERS FROM SOILS.

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The subject of the leaching of fertilisers from cultivated and uncultivated soils stands out as one on which but little is known by practical agriculturists. This short article is therefore written with the purpose of supplying some information on the subject to those readers of this Journal, the great majority of whom are practical men, who perhaps have not had the opportunity of acquainting themselves with the results of scientific investigations on this important practical problem. Very little systematic work of this nature has been done in the Tropics, but at the Experimental Station at Rothamsted, Harpenden, England, experiments have been carried out continuously since 1870 to ascertain the loss of soluble fertilisers through drainage waters. The results of these bear out the fact that the losses from the soil of some of the most extensively used fertilisers is a factor that must undoubtely be reckoned with. It is true the climatic conditions of the temperate regions differ from those of the Tropics, but if one considers rainfall only, the difference is merely one of degree, the rainfall of tropical regions being far more excessive. The liability of fertilisers to be lost from tropical soils through rainfall, drainage, and percolation is therefore greater than from soils of the temperate zone.

The experiments carried out at Rothamsted on the subject of the leaching of fertilisers from soils have been so systematic and the results obtained so conclusive, that one could do no better than embody in this article a summary of these experiments and of their results. Experiments were carried out to ascertain the leaching of fertilisers both from uncropped and unmanured soils, and from continuously cultivated soils. In the latter case, *e. g.*, the wheat plots on Broadbalk field, each plot was drained at a depth of from 2 feet to 2 feet 6 inches below the surface, and the drainage waters from these collected and analysed. For experiments with unmanured and uncropped land 'drain-gauges' or 'lysimeters' were constructed by building cement walls round blocks of earth *in situ*, and then gradually introducing a perforated iron plate below to carry the soil. These lysimeters were constructed to two depths, *viz.*, 20 inches and 60 inches. The water draining from these lysimeters was collected every day and analysed.

Let us now consider what happens when each of the more important soluble fertilisers is applied to the soil, so far as their retention by or leaching from the soil is concerned. Of the nitrogenous fertilisers the nitrates of soda and of lime, the salts of ammonia and urea are freely soluble in water: Superphosphate alone of the compounds of phosphoric acid is soluble. The potassium fertilisers are all soluble.

Soil contains among other constituents clay and organic matter (humus). Now these two constituents of soil give to it certain properties which are peculiar to a class of substances called "colloids." Among other properties colloids have the characteristic power of "adsorbing" from certain solutions the substances dissolved in them. Besides this purely physical process, there may also be a chemical interaction between the salts in solution and certain chemical constituents of soils—the double silicates known as zeolites, and calcium humate.

Experiments carried out by Way and Thompson, and later by Voelcker, have shown that all organic compounds of nitrogen, ammonium salts, phosphoric acid and potash were removed almost wholly from solution by ordinary soil, but that nitrates, sulphates and chlorides, chiefly of sodium and calcium, were not retained.

These experiments are confirmed by the analyses of water from the land drains. Ammonia, phosphoric acid and potash are found to occur only in very minute quantities, but nitrates, sulphates and chlorides of calcium and sodium occur in large amounts.

The Application of Sulphate of Ammonia to the Soil.—When sulphate of ammonia is added as a fertiliser to the soil, the soil water dissolves the particles of the fertiliser, and eventually the whole of the fertiliser goes into solution. There is no downward drainage or leaching of this solution, for part of it is adsorbed by the soil colloids, and part interacts chemically with the zeolites and humus and thereby becomes "fixed." Between the "zeolites" or double silicates of aluminum, calcium, etc., and the sulphate of ammonia in solution, there is an interchange; the ammonia replaces the calcium of the zeolite and this combines with the sulphuric acid of the fertiliser to form calcium sulphate which is washed out of the soil in the drainage water. Salts of calcium are therefore usually found in considerable quantities in the soil water. The action of these physical and chemical factors results in the sulphate of ammonia being confined to the upper layers of soil. In the course of time sulphate of ammonia is converted by nitrifying bacteria to nitrate in which form only can it be taken up by most plants. As a result of this, any losses that the sulphate of ammonia will undergo, will be in the form of nitrate. Mention must be made here of the effect of the continuous application of sulphate of ammonia to a soil. This results in the depletion of its stores of calcium carbonate, which is brought about by the double decomposition it effects with the chalk or calcium carbonate in the soil, ammonium carbonate and calcium sulphate being formed. As the ammonium carbonate is nitrified, more calcium carbonate is utilised, and more calcium washed out into the drainage waters.

An examination of the results obtained at Rothamsted by the study of the composition of drainage waters from Broadbalk Field, shows that the amounts of ammonia found in the drains is very minute. When 400 lb. of ammonium salts per acre were applied to the plots, the amount of nitrogen as ammonia found in the drainage waters was not more than .20 parts per million of solution. The effect, however, of adding ammonium salts or organic compounds of nitrogen to soils, is to increase the proportion of nitrate in the drainage water. Thus where minerals only are applied and no nitrogenous fertilisers, the amount of nitrogen as nitric acid found in the drainage water was 5.10 parts per million; with 200 pounds ammonium salts, 8.50 parts per million and with 400 pounds 14.0 parts per million of nitrate were respectively found. The amount of lime found dissolved in the drainage water, as was to be expected, increased with an increase in the amount of ammonium salts. Thus, whereas the quantity of lime in the drainage water from unmanured plots was found to be 98.1 parts per million, with the addition of 200 pounds ammonium salts + minerals the quantity increased to 143.9 parts per million; 400 pounds of ammonium salt increased it further still to 181.4 parts per million. Nitrate of soda has not the same effect on the leaching of the calcium salts from the soil as sulphate of ammonia, and the experiments at Rothamsted demonstrate that the addition of minerals + 550 pounds nitrate of soda per acre to the unmanured plot gave only 118.1 parts per million of calcium in the drainage water.

As regards urea, little need be said, for on application to the soil it is converted into the carbonate of ammonia in which form it is fixed by the soil; the nitrogen it contains is thus not easily lost through leaching.

The Application of Nitrate of Soda to Soils.—Nitrate of soda is one of the most widely used nitrogenous fertilisers, and at the same time one that is most easily lost to the soil through drainage and percolation. Unlike sulphate of ammonia, there is no chemical interaction between it and other constituents of the soil, nor is there any "adsorption" of the fertiliser from solution by the soil. Moreover, nitrate of soda suffers from the disadvantage, from the point of view of leaching from the soil, that it is taken up by the plant almost immediately, whereas sulphate of ammonia has first to be converted into the nitrate before it can be utilised by the plant.

An application of nitrate of soda to the soil followed by rain, will result in great loss of the fertiliser through percolation into the drainage waters. That this is so is exemplified by the experiments at Rothamsted. Here where the rainfall does not amount to much more than 30 inches per annum, the amount of nitric nitrogen lost to the drainage waters on the addition of 550 pounds nitrate of soda per acre is no less than 18.4 parts per million, as compared with 5.10 on the unmanured plot. The amount of nitrate found in drainage water will naturally depend on the season. Nitrates, in the temperate regions, should be applied as fertilisers in early spring, as then the crops need them for purposes of growth: but in the Tropics, the application must be considered chiefly from the point of view of rainfall.

What applies to nitrate of soda, holds equally good for nitrate of lime, and nitrate of ammonia. The former is deliquescent even when exposed to the atmosphere and hence is easily lost to the drainage water.

A word on Calcium Cyanamide will not be out of place. Calcium Cyanamide though not soluble in water, is transformed in the soil into urea and ammonium carbonate and hence is comparable in this respect to sulphate of ammonia.

In connection with the leaching of nitrates from uncropped soils, Russell and Richards summarise the results of experiments that have been carried out at Rothamsted without interruption since he year 1870. The drainage waters from the 20 inch and 60 inch gauge lysimeters, in both of which no crops were grown, were collected and analysed. As far as could be ascertained from the analyses, the nitrogen lost from the soil was found to be wholly in the form of nitrate. The amount of nitric nitrogen lost to the drainage water per acre per annum was 40 pounds. At the beginning of the experiment the percentage of Nitrogen in the top nine inches of soil was ·146, equivalent to 3,500 pounds per acre. At the end of fifty years, the percentage of Nitrogen was ·099, equivalent to 2,380 pounds per acre. The rate at which the nitrate was lost was comparatively slow. To account for this slow rate of loss of nitrogen from the soil, Russell has put forward the theory that soil organisms—algae, fungi and bacteria—accumulate the nitrate or the ammonia present in the soil, and on their death, decompose, giving rise ultimately to nitrate. These experiments also demonstrated that the amount of nitrate washed out from the soil was closely related to the rainfall.

The Application of Potassic Fertilisers to Soils.—Results of experiments at Rothamsted show that, like ammonia, potash is adsorbed by the soil, and the greater portion of it retained near the surface. Caustic potash is adsorbed directly, but in the case of the sulphate, nitrate and chloride of potash, the base is adsorbed, and the acids set free combine with the calcium or other bases of the soil, forming soluble neutral salts which are lost in the drainage waters. Thus calcium sulphate, nitrate and chloride are found in comparatively large quantities in the drainage water, whilst the amounts of potash are very small. At Rothamsted, analyses of drainage water from the wheat plot to which potassic minerals only were applied, showed that whilst the amounts of chlorine and sulphuric acid found were 11.1 and 66.3 parts per million respectively, the quantity of potash was only 5.4. Minerals + 200 pounds ammonium salts showed 20.7 parts of chlorine and 73.3 parts of sulphuric acid, but only 4.4 parts of potash in the drainage waters. Minerals + 400 pounds sulphate of ammonia gave only 2.9 parts per million of potash, but increased the chlorine and sulphuric acid to 26.1 and 90.1 parts per million respectively. The use of nitrate of soda was found to increase the amount of potash in the drainage water. Thus with Minerals + 550 pounds nitrate of soda, the amount of potash found in the drainage water was 4.1 parts per million. In the case of Kainit, the chloride it contains is usually lost in the drainage waters.

The Application of Phosphoric Acid to the Soil.—The usual phosphates applied as fertilisers to soils are superphosphate, basic slag and mineral phosphates. The two latter are, generally speaking, insoluble in water and hence are not lost to any appreciable extent in the drainage water. Superphosphate on the other hand is very soluble in water, and might therefore be regarded by practical agriculturists as a fertiliser that could easily be lost to the soil. This however, is not the case, for superphosphate, on being added to the soil, reacts chemically with the calcium carbonate, hydrated ferric and aluminium oxides of the soil to form compounds insoluble in water. Thus, on the addition of superphosphate to soils, insoluble calcium, aluminium and ferric phosphates are immediately formed. Wherever calcium carbonate is present in soils, the soluble superphosphate interacts with it and precipitates the di-calcium or "reverted" phosphate. This is insoluble in water, but soluble in water containing carbon dioxide. On soils poor in calcium carbonate, and where iron and aluminium oxides are consequently abundant, phosphates of iron and aluminium are chiefly precipitated. These are insoluble in water containing carbonic acid, and are practically lost to the plant. To the latter class of soils lime must therefore be applied before the addition of the superphosphate. Besides the chemical changes it undergoes in the soil, phosphoric acid also undergoes the phenomenon of adsorption by the soil. Thus, there is no fear of excessive loss of phosphoric acid in the drainage water. In fact, analyses of drainage waters show that the amounts of phosphoric acid present in them are hardly appreciable.

Another fact following on what has been stated in the foregoing, is that the phosphoric acid of soils is usually found to a very considerable extent in the top nine inches of soil. Dyer found that no less than 83 per cent. of the acid was found in the surface soil, and 27 per cent. in the subsoil, *i. e.*, from 9 to 18 inches. An examination of the analyses of drainage waters at Rothamsted shows that the amount of phosphoric acid was never more than 1.66 parts per million. That was where superphosphate and 400 pounds of ammonium sulphate per acre were applied to the plot. The further addition of sulphate of soda or potash to this mixture resulted in a lowering of the amount of soluble phosphoric acid to 1.09 parts per million.

What has been stated in the foregoing refers chiefly to the results obtained at Rothamsted from an examination of the drainage waters of the wheat plots on Broadbalk field. They confirm in general the conclusions which were arrived at from a consideration of the question from chemical and physical grounds alone. The quantities of different fertilisers lost to the drainage water will, however, vary with the type of soil, the slope of the land, the crops cultivated, and the rainfall. Other experiments at Rothamsted have shown that more leaching takes place from light soils than from the heavier marls, loams and clays; but irrespective of the type of soil, the same general results regarding the loss of fertilisers from soil were obtained. With regard to the crop grown, it is well known that different crops respond differently to different manures. The loss through leaching of a particular manure when applied to a particular crop for which it is most suitable, will be less than when applied to another crop for which it is not so suitable. Thus nitrate of soda is more advantageously applied to the wheat crop than to barley, and there will be certainly less loss of the nitrate of soda through drainage from the wheat plot than from the barley. That the loss of fertilisers from the soil is dependent on the rainfall and slope of the land is evident to every one and needs no further reference.

SUMMARY.

As is well known, all nitrogenous compounds when applied to soil are converted into nitrates, and so are liable to be washed out into the drainage water. Nitrate of soda and nitrate of lime are, of all soluble nitrogenous fertilisers, the most easily lost from the soil, unless applied at a time when they could be very quickly assimilated by the growing plant, and when the rainfall is low. Excessive rain will leach out a large percentage of these fertilisers from the soil. The reason for this is that nitrate of soda is not "fixed" by the soil. Sulphate of ammonia on the other hand is "fixed" by it and hence not easily lost to the drainage waters. In fact, but little nitrogen is found in the drainage water in the form of ammonia, though a certain amount is lost as nitrate. Urea and calcium cyanamide are not lost from the soil as such but as in the case of sulphate of ammonia a small porportion is lost as nitrate. With potash there will be but little loss, as it is largely adsorbed by the soil; but where kainit is used, the hydrochloric acid it contains will be washed into the drains. When sulphates are applied to the soil, *e.g.*, sulphate of potassium, the potash is adsorbed by the soil, but the sulphuric acid is washed out. No fear of loss of phosphoric acid applied in the form of superphosphate need be entertained, as the latter is fixed in the soil almost as soon as it is applied to it. Of all the soluble chemical fertilisers, this is the one that is least affected so far as leaching from the soil is concerned —Tropical Agriculturist Vol. LXIII No. 5.

YOUTH AND AGE IN PLANTS.

The majority of plants pursue the even tenor of their way from youth to age without vouchsafing to any but the most observant that they suffer from any of the "growing pains" incidental to the growing up of human youths. It is true that there is often to be seen a big break in the continuity between the germinating seed and the newly-established seedling. The first efforts of the seedling in the way of leaf formation are but feeble, and from them the scale leaves only result. With the vigour which comes to the establishment of independence the first rough leaf is formed, and often enough it is of mature form like unto all the leaves which will be produced thereafter. Another break of continuity which marks a tide in the affairs of plants may be observed when the plant becomes adolescent—ripe to flower. At this period also the flower-bearing branches, intent, as it were, on their business, all but forget that it is customary for a branch to bear leaves, and only produce perfunctorily, one or two mere rudiments of leaves which the botanist calls bracteoles or prophylls. Some Orders of plants, the Cruciferæ, for example, give up the pretence altogether, and their flowering branches—without respect for the tradition that branches should bear leaves—produce their flower buds without any preliminary production of prophylls. The turnover from vegetative to flower-bearing state, which must undoubtedly be accompanied by wide-spread change in the whole plant, takes place often with effortless ease. So smooth is the passage from vegetativeness to floriferousness that even now little or nothing is known of the inward change which leads to the outward grace of flowering. There are, however, plants which, as is well-known, take a long time to grow up—as measured by their flowering—and others which never grow up at all. The once flowering

Palms,* Agaves, and the like, which go on living and growing in leisurely fashion for long terms of years, then flower, fruit, and die, are instances of the former. Many New Zealand plants which have juvenile non-flowering forms and the Retinosporas—permanent juvenile Conifers—are among the many well-known examples of the latter. What makes the once-flowering Palm at long last reach maturiy, and what causes it to die when it has set its seeds, are alike unknown. Some say that the trees are worn out by the heavy work of seed and fruit production, but this is only an example of the all too frequent application of the obvious. It is more likely a case of plant suicide; and all the yearly deaths of annuals may well prove to be so many examples of self immolatlon in the interests of the race—"The individual withers and the world grows more and more. There is much in the anatomy of herb and herbaceous perennials to suggest that they are not the sort of stocks whence perennial trees evolved, but rather that they are degenerate members of races which once enjoyed the stature and status of long-lived and frequently-flowering trees. The world went very well then, in that far-off time when most Dicotyledons and Monocotyledons enjoyed, as is supposed on this hypothesis, a tree-like habit. But as climate evolved, becoming more unequal over the face of the earth, tree forms of vegetation were confined to the districts with constant water-supply; from the other areas, as trees, they were banished. Some "went out" for good and all, others began to take a lower place, until at last what was once a tree may now be the ephemeral and minute herb which springs up, matures, bears flowers and ripens seeds within the space of a few weeks. Any one who tends plants may observe signs—it may be slight, yet nevertheless sure, that fertility is not a mere inevitable event which ensues from lapse of time. An interesting instance of the peculiarity of the state of a plant with respect to flower bearing is described by Mr. L. B. Stewart in the case of a species of Gardenia.* A cutting from the main vertical stem of the plant goes on growing for twenty years or more without flowering, but if cuttings are taken from one of the side branches the plants which arise are of branching growth and flower regularly year by year. What they gain in floriferousness they lose in mere stability. For whereas the non-flowering, upright plants live on unflowered, the bushy, dwarfer plants which flower after a few years produce root suckers which, like a Rose stock overgrowing its scion, pushes up as an upright stem, that, unless removed, "sucks the verdure" out of the other, so that the bushy plant by its side ceases to flower and presently dies.—*Gardeners' Chronicle, Vol. LXXVII. No. 1985.*

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* An excellent specimen of a once flowering Palm, the Taltipot of India. (*Corypha umbraculifera*) is now flowering in the grounds of Government House and can be seen from Carmichael Street. It takes about 23 years to flower and fruit and then dies. Editor.

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* Transactions and Proceedings of the Botanic Society of Edinburgh, XXIX., Part 1, 1924.

A NEW USE FOR CACAO.

In times of over-production of an agricultural product or of low prices and sluggish market, the development of new ways of using up material has often proved of great help to the industry. The investigations along this line by the rubber industries since 1913, have been fruitful of results. Forseveral years now the cacao market has been depressed and it would appear that a possible new use for cacao, which may in the future considerably increase its consumption, has been found in the development of cacao bread. The United States Department of Agriculture carried out experiments which resulted in a bread being prepared in which from 8 to 10 per cent. of the flour used was substituted by cacao powder, and the shortening usually supplied was omitted, as this is supplied by the cacao, presumably by the fat which it contains. This bread has now been manufactured in Trinidad according to the United States' recipe and has been pronounced by many who have tried it to be very palatable and likely to meet with some demand. If such a demand became general the consumption of cacao might be increased.—Tropical Agriculture. Vol. I. No. 10.

A GUIDE FOR BEGINNERS IN CHICKEN RAISING.*

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The following extract is taken from an Article in the Phillipine Agriculturist Vol. XIII, No. 8:—

The raising of chickens, if properly developed, could be a prominent branch of agriculture. The ease with which chickens adapt themselves to new conditions makes it possible to grow them as a side issue with almost any vocation. Also chicken raising is an industry in which all the members of the family can take an active part; the chickens being small animals and harmless, even children can help take care of them. The demand for chicken products, eggs and poultry, is ever increasing. With all of these advantages, to say nothing of the pleasure and satisfaction derived from the keeping of chickens, there would seem to be no reason why most families should not keep enough chickens to amply supply their needs, at least.

The importance of chicken raising is gradually being recognised. This guide was written to meet the many demands for information on chicken raising; if the principles and advice here set forth are of use to beginners, whether on a large or a small scale, the object of the department in publishing it will have been attained.

In this circular, the writer does not aim to give a set of directions that will meet all troubles of beginners in chicken raising, as this is impossible. Probably in most cases the common sense of the chicken raiser will play the most important role. The poultry raiser should have good judgment, which can be formed only by actual experience in caring for chickens and by carefully study-ing their habits and their manifold requirements. Knowledge gained from study and reading of published material on the subject of chickens will help to form good judgment and be a guide in special cases. It is hoped that the information given in these pages may be of help to the chicken raiser while he is getting his experience.

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* Experiment Station contribution No. 261; Circular No. 5.

CLASSES OF CHICKEN RAISING.

Back Yard Chicken Raising.

The keeping of chickens in the small lots back of city and town residences is called back yard, or suburban chicken raising. There is no reason whatever why many residents of a city or of a town cannot supply a part of the family's table needs from a well cared for, well fed, and well managed flock of chickens. Kitchen and table scraps, which if thrown into the garbage can are wasted, can be converted into eggs and meat if fed to chickens before the scraps have started to decay. Men and women who work indoors all day will find rest and recreation working outdoors taking care of chickens in their hours at home. Children can be taught to find interesting occupation in raising chickens. They will not only add to the family's support by so doing but will develop habits of industry and love of poultry.

Farm Flock Raising

The keeping of chickens by residents of villages as a side line of general farming is known as farm flock raising. A farmer's home is hardly a real home without chickens; no farmer should be without them. Raising chickens on a small scale is so easy that if the farmer himself cannot take care of them, other members of his family can. In this kind of poultry raising the fowls find their own feed; the hens steal their nests, are exposed to unfavourable environment, and consequently lay but few eggs and raise only a few chickens. If, instead of such practices, the chickens were properly housed, given some additional feeds so that they would not have to spend most of their energy hunting for their subsistence, the eggs and meat would be more than double the present production.

Chicken Farming.

The raising of chickens on a farm devoted exclusively to the industry, where it is the principal source of the farm income is chicken farming. When carried on as a business, chicken farming is not a simple easy occupation. Many people think that for this business, neither special fitness nor special training are required and that it can be gone into without preliminary preparation. They do not realise that chicken farming requires brains, ability, experience, and the exercise of care and judgment in all the operations on the farm. The beginner in chicken farming will find that it will be to his distinct advantage to start on a very moderate scale and get experience in all of the phases of the business before he makes large investments in it. He can enlarge his capacity gradually as he feels himself growing in competency. A right beginning is always a pre-requisite of a successful ending, and the beginner in chicken farming will be the gainer if he learns the business little by little.

Breeds To Use.

The different breeds of chickens may be arbitrarily classified into groups according to the purpose for which their type appears most efficient and for which they are supposedly bred. These breed groups are: (a) Egg Breeds; (b) Meat Breeds; (c) General Purpose Breeds; and (d) Fancy Breeds.

Egg Breeds.—These breeds are characterised by their rather small size. They are layers of large white eggs; are active and nervous in temperament, early maturing, non-sitters, and because of their activity, are good foragers. These breeds are clean-legged, that is, they have no feathers on the shanks; they have white or creamy white earlobes. Leghorns, Minorcas and Anconas belong to this group.

Meat Breeds.—These breeds are large, phlegmatic, slow in movement, and quiet and gentle in disposition. They are poor foragers, and, as a rule, are poor layers. Most of the meat breeds lay brown-shelled eggs, and in general are sitters and make good mothers. Some of the ones with feathered shanks, however, are inclined to be clumsy and are apt to step on the chicks. The birds of this group are late maturing. Brahmas, Cochins, and Langshans are the principal breeds of this group.

General Purpose Breeds.—These are medium-sized fowls, good layers, and their carcases are well suited for the table. They are less active than the egg breeds, but more so than the meat breeds. They are layers of brown-shelled eggs. The general purpose hens are good sitters and make fine mothers. Where they are kept, natural methods of incubation and brooding can be used. They are fairly good foragers. Plymouth Rocks, Rhode Island Reds, and Wyandottes belong to this group. The Cantonese is also a general purpose fowl.

Fancy Breeds.—The birds of this group may be characterised by the decided beauty of plumage or form or because of their rare or unusual appearance. They often possess considerable economic value, but most of them are raised chiefly as ornamental fowls without regard to their useful qualities. Fizzles (baligtad, Tag). Silkies, and Bantams belong to this group.

What Breed to Use.

There are a number of factors that will aid in choosing the kind of fowls to keep. In the first place, the breed desired should be available and fairly cheap. The Cantonese for the general farm is a fairly good general purpose chicken and is very hardy. It thrives well in practically any kind of environment. Beginners who cannot afford to buy both Cantonese hens and roosters, should, at least, use a Cantonese rooster to mate with their Native hens.

If it is desired to raise standard bred fowls, a general purpose breed should be given preference, as there is as much demand for eggs as for poultry. Of the several imported general purpose breeds, the one that has been found best adapted to the local environment should be selected. In this College, the Rhode Island Red and the Barrel Plymouth Rock have proven to be better than other breeds in this respect. Experience in various other places seem to point to the same conclusion. Mono-purpose breeds, as Legnorns for instance, find their most appropriate places only on rather highly specialised poultry farms.

SELECTING THE LAYING STOCK*

Vigour

A sound body is a requisite of a good laying hen; she should be vigorous and healthy. Vigour and health are shown by a bright, clear eye, a well set body, active disposition and a good circulation. The hen must be free from physical defects, such as crooked beak, excessively long toe nails, eyelids that overhang so that she cannot see well, scaly leg or any defect that would keep her from getting an abundance of food.

Type

The general make-up of a hen indicates the rate of her egg production. To make a record, a hen must not only lay for a long time but also heavily. To do this, she must have sufficient body capacity to digest large amounts of food rapidly. This capacity in a laying hen is shown by a body that is deep, a fairly straight under line and a fairly horizontal back. The back should be also flat and wide with the width carried well back to the tail. The back that tapers decidedly or slopes down indicates poor capacity for digestion. The breast should be full, deep, and prominent. The neck should be fairly short and well set. The legs should be of moderate length. The long-legged round-shanked hen is not a good layer. The keel bone should be long and generally curved.

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*The discussion on this topic was taken largely from the report adopted by The American Association of Instructors and Investigators in Poultry Husbandry. (1)

The head should be moderately fine with large bold eyes set well out on the side of the head in an oval eye socket. The head should be wide and flat at the top, and wider on top than below the jaws. A flat-headed, bony or crow-headed, small round-eyed, or cross-eyed bird or one with overhanging eyebrows, or having a comb with extremely narrow serrations is not likely to be a good egg layer.

Signs Of Laying.

A laying hen has a large, moist vent, showing a wide, dilated condition and looseness, while a hen that is not laying has a hard, round, dry, puckered vent. The whole abdomen, as well as the vent, is dilated so that the pelvic arch is wide-spread and the keel forced down away from it. The greater the number of eggs a bird is going to lay in succeeding days, the greater will be the size of the abdomen. Its actual size is influenced by the length of the keel, the size of the eggs laid, and by the size of the bird. A sagging abdomen is undesirable.

The quality of the skin and the thickness and stiffness of the pelvic bones indicate heavy production. With egg-laying, fat disappears from the skin and body so the good producers have a good velvety skin that is not underlaid with layers of hard fat. The abdomen in particular is soft and pliable. The sternal processes are very prominent and are generally bent outward. The thicker and the blunter the pelvic bones and the greater the amount of hard fat in the abdomen, the less the production. This condition indicates also the time since production stopped.

If the comb, wattles, and ear-lobes are large, full, plump and smooth, or hard and waxy, the bird is laying heavily. If the comb is limp, the egg production is only light. When the comb is dried down, especially at the time when the hen is shedding her feathers she is not laying at all. If the comb is warm, it is an indication that the bird is coming into production.

Temperament And Activity

A good layer is active, intelligent, friendly and more easily handled than a poor layer. She is almost always the first one to leave the roost in the morning. A low producer is shy and flighty and stays near the edge of the flock most of the time. A poor layer will always squawk when handled.

HOUSING

Chicken houses should be made to imitate the birds' natural habitat. They should be dry, roomy, airy but not drafty, and should afford protection against wild animals. Such a house can be built at little cost and not much labour. The common practice of housing under dwelling houses cannot be too emphatically condemned. Besides being unsightly, it is insanitary for the family and not good for the chickens. If the chickens are housed in a separate shed very close to the residence, the protection from night marauders, both human and animal will be secured.

Location

Care should be taken to select a high and dry place for a poultry house. There should not be any place near where water can collect and become stagnant during the rainy season. Dust in the dry season can be prevented by growing a permanent sod around the house. The ground surrounding the house should be tilled at least once a year to prevent its becoming sour. There should be enough space near the house to grow crops for the chickens. Finally, the site should be laid out so as to provide for future expansion.

There should not be any thick growths near the chicken house as these serve as hiding places for wild animals. There should, however, be plenty of natural shade and green grass near by, for these are good breeding places for insects, worms, and bugs, besides providing seeds of weeds which may be relished by the chickens. A very large run will also minimize the annoyance caused by the chickens going in the owner's house. Plenty of feed and a good grassy run will help break this bad habit.

The Poultry House.

A good chicken house can be made out of bamboo with either nipa or cogon for roofing, and for those living in cities or towns cheap packing boxes and petroleum cans can be utilized. Nests can be made out of woven bamboo strips or out of kerosene packing boxes. Drinking troughs can be made of bamboo joints or an open vessel, either earthen or metal, will answer.

Poultry feeds can be stored in petroleum cans, which are cheap and rat proof and if painted will last a long time. Such rat proof containers, properly covered, will soon pay for themselves in the feed saved from being wasted or eaten by rats.

Fencing.

On the farm, the chickens should be allowed the run of the fields but vegetable and flower gardens should be fenced and protected from them. Being allowed to run in the fields chickens can forage for themselves and pick up bugs, insects, worms, and stray grains. By consuming bugs and insects, which make excellent animal food for the chickens, they help protect the crops against these pests. Also in running over the farm they deposit droppings which aid in fertilizing the soil.

In cities and in towns the chicken lot should be fenced. The chickens, however, should not be confined too closely, as this will help increase danger from disease. If the lot is large enough it should be divided into two parts and each lot cropped to corn alternately. When thus fenced in the chickens should be given more care and better feeding than when they are allowed to run at large.

FEEDING.

Essentials Of Poultry Feeding.

Chickens should be given feeds that are nutritious and palatable; they should be neither too bulky nor too concentrated. They should not have any bad effect upon the system of the bird, nor should they impart any undesirable flavour to the eggs. Above all, the feeds should be easily secured and cheap and, if possible, they should be only products and by-products that would otherwise go to waste on the farm. These feeds should be given in the form of grain, either whole or cracked, and mash consisting of finely ground products, fed either dry or wet. The grain feeds furnish the greater part of the carbohydrates and the mash supplies most of the proteins.

Compounding Of Poultry Rations[3]

As a general rule, poultry feeding is carried on with one of four productive purposes in view: (1) laying, (2) growing, (3) fattening, or (4) breeding. The ration should be adapted to the purpose, otherwise there will be an unnecessary waste of nutrients. Laying rations should contain more protein than carbohydrate and should be given in form of grain, whole or cracked, and mash mixtures. The growing ration for young chicks is similar to this except that the ingredients are less in quantity and the proportion of both ash and protein is greater. The fattening ration should be in such form, condition, consistency, and palatability as will facilitate consumption of large amounts, and insure rapid digestion and assimilation. This is made up entirely of grain, either whole or ground. The breeding ration, in general, is frequently the same as the laying ration.

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[3] In poultry husbandry, the term ration usually refers to the composition of the daily diet of fowls.

How To Feed Poultry For Profit.

There is no hard and fast rule as to the particular poultry ration to use. A certain ration found profitable under one set of conditions may be a failure under another, and feeds available and cheap in one region may not be in another. The safest guide is to use whatever feeds are available, the proportion of the different ingredients to be governed according to the object in view.

Feeding the young newly-hatched chicks.—Hard boiled infertile eggs, chopped very fine, shell and all, and mixed with four to five times its bulk, either of bread, crumbs, boiled rice, or rice bran may be given to newly-hatched chicks. This mixture should be given at regular intervals, four to five times during the day, giving only a little at a time. Fine grit, plenty of green feed, and clean cool water should be available to the chicks at all times. This mixture can be fed to them during the first week of their lives, about one egg to every thirty chicks a day.

Feeding the older chicks.—A mash mixture composed of two parts by weight of rice bran, one part of rice shorts (*binlid*), one part of copra meal, and one part of dried shrimps may be given four times a day. If dried shrimps are not available, either ground snails or *anay* may be fed at noon, giving enough to keep the chicks busy for about twenty minutes. Fresh clean table scraps may be used to great advantage. The chicks, in addition to this, should be given a chance to run out in the yard as much as possible, and receive plenty of sunlight which is essential for their normal growth.

Feeding the growing stock on a wide run.— Young chickens kept on a wide run may be fed either cracked corn or palay or both, and a mash mixture composed of one part each by weight of rice bran, of rice shorts (*binlid*), of corn meal, of copra meal, and of dried shrimps. This mash mixture should be available to the birds all day. If shrimps cannot be secured, some form of meat food as ground snails or *anay* should be given instead. Fresh table scraps may also be given. If the runs have a good vegetation, the chickens may get enough insects, bugs, and worms to supplement the feeds given them.

Feeding the laying hens.— A very simple, fairly cheap laying ration, and one which may be easily secured is:

Grain: Cracked corn or an equal mixture of
corn and palay.
Mash: 2 parts rice bran
1 part rice shorts (*binlid*)
1.5 parts of copra meal
0.5 part dried shrimps.

Where a corn grinder is available, one part corn meal may replace one of the two parts of rice bran. The meat food may be omitted from the mash if it cannot be obtained at a reasonable price and table and kitchen scraps given instead, and enough ground snails to keep the chickens busy for about twenty minutes at noon.

Feed the hens only enough grain to partly fill their crops in the morning so that they will hunt for more out in the run and thus get exercise. Feed the mash in troughs left open all day; if wet mash is given, feed only enough to keep the chickens busy for about ten minutes at noon. Before the birds go to roost at night, give them all the grain they can consume so that they go to rest with their crops full.

It should not be forgotten that laying hens need plenty of clean cool water. The drinking troughs should be cleaned and refilled at the time the hens are given their morning grain. Green feeds stimulate the production of eggs, and for this reason a good sod around the poultry house is a necessity. A wide grassy run is also necessary, for too close confinement in a barren yard favors a quick souring of the soil and the multiplication and spread of disease germs and parasites.

Feeding for fattening.—Corn is one of the best grains for fattening chickens. Confine the birds to be fattened in a small pen and give them all the corn grain that they will consume readily. Do not give too much at a time or they will tire of it. Continue feeding them this way until the birds are fat enough to satisfy the feeder.

A mash of equal parts of corn meal and rice bran, moistened to a sloppy condition, is a good fattening feed. Confine the birds in a small cage and fast them for about twenty-four hours before giving them the mash. Soft boiled rice may be added with advantage to this mixture. Chickens may be fattened on boiled rice alone. The birds that are being fattened should not be disturbed, and, if possible, the fattening cages should be placed in semi dark corners. The birds may become fat in a week, but this depends of course upon the degree of fatness desired. In any case, the fattening process should not last more than two weeks as the birds begin to lose weight after about that length of time.

INCUBATION.

Only eggs from vigorous and healthy birds should be used for hatching purposes. These eggs should be uniform in size, shape, and colour, and the shells should be sound in texture and free from ridges and excrescences. The belief that the long, narrow eggs hatch only male chicks, and the short, round ones only female individuals is unfounded. Either kind will in the long run produce females and males, about fifty-fifty. The eggs to be hatched should be as perfectly oval in shape as possible. The egg shell provides a perfect natural protection against disease germs, but when dirty eggs are washed the natural protective covering of the eggs is rubbed off. More vigorous chicks will be hatched from unwashed than from the washed eggs, and for this reason, unless the eggs are extremely dirty, they should not be washed if they are to be used for hatching.

Holding Hatching Eggs.

When holding eggs for hatching, care should be taken that they are kept in a dry, airy, cool place. Hatching eggs should not be held too long; ten days is the longest even under the very best of conditions, and only in exceptional cases should eggs more than fifteen days old be incubated. A common practice all over the Philippines is to store the eggs in small receptacles containing *palay,* rice bran, or rice hulls. This certainly will help to minimise breakage during holding the eggs previous to hatching, but the bad result of the practice is that such containers are apt to be warm, thus favouring evaporation from the eggs and allowing the embryo chicks inside the eggs to develop. This method of holding, however, is much better than letting the eggs stay in the nest uncollectel from the time the first egg is laid until the last chick has hatched. This is a wasteful practice, as the number of rotten eggs, especially during the dry season, is large. The eggs should be gathered every day, with probably one or two eggs left in the nest to serve as a bait. A good way to store eggs is in a basket lined with stripped fresh banana leaves renewed from time to time. as such a holder is cool and well ventilated. Hatching eggs should not be kept near odorous substances as kerosene, gasoline, oil, onions, etc. as eggs absorb these odours readily and it spoils them.

Artificial And Natural Incubation.

Whether incubation is artificial or natural, the principles involved are the same. The artificial incubator is an imitation of the natural process, but there are certain limitations which should govern its use. Although it has been found to be possible to carry on artificial incubation successfully without the use of an especially built cellar, it is only advisable when poultry raising is done on a large scale. If it is desired to hatch eggs artificially, miniature-sized incubators, 70 to 85 egg capacity, will be found the most desirable for beginners[4]. As a warning, however, the operator is cautioned to exercise special care in running an incubator as the danger from fire is very great.

Hatching with hens, even with as many as one hundred, is the most practical. Natural hatching is safer, more reliable, and more economical than artificial hatching. No previous experience is necessary. One of the drawbacks in the use of natural incubation is that it is difficult to raise chicks that are free from lice and mites.

The sitting hen.—Care should be exercised in selecting hens for hatching. Only the tame, vigorous, and healthy ones should be chosen. Above all, the hens should be fairly large and broody. Hens that are badly infested with lice or with scaly legs should never be used for sitting.

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[4] Detailed directions for operating an incubator are furnished by the manufacturer.

The hatching nest.—The hatching nest should be roomy and placed where it is cool and well ventilated. It should not be placed so high that the hen will have to fly into it, nor so low that she will be annoyed by dogs and other animals. The nesting materials should be soft and pliable and arranged in the nest so as to form a hollow hemisphere which will prevent the eggs from breaking or rolling out from under the hen. If hatching is done during the warm months, a layer of moist earth may be placed in the bottom of the nest under the nesting material to help reduce the evaporation from the eggs and to slightly increase the percentage of hatch.

Management of the sitting hen.—The sitting hen should have at her disposal plenty of clean, cool water and whole grain, either corn or rice. She should be provided with a place where she can dust herself freely. A very fine mixture of one part ordinary clean road dust, two parts of wood ashes, and one part of lime placed in an open box near the hatching nests will be satisfactory for this purpose. The nesting material should be burned after every hatch and the nest thoroughly cleaned. The droppings inside and around the nest, as well as eggs that may be accidentally broken, should be removed promptly and the dirty nesting materials should be replaced with clean. During the very warm months mites multiply very rapidly and greatly annoy the sitting hens, reducing their vitality and sometimes causing their death. Only strict sanitary precautions will prevent these pests from troubling the sitting hens.

When to hatch.—It has been observed that better hatches may be obtained from eggs incubated during the cooler months, from October to February, than during any other month of the year. Except during the latter part of this period, January and February, egg production is very low. The eggs produced during the months from October to December should be sold to take advantage of the high price owing to scarcity in the market. Hatching during the rainy and stormy months, from June to September, has a disadvantage in that it is very hard to raise young chicks when they are exposed to very uncertain weather conditions. It is unquestionably much better to hatch eggs during the dry season, January to May, the earlier in the season the better, for then the chicks can be easily raised. Another advantage is that there is usually not much work on the farm during these months, hence more time and attention can be paid to the care and management of the young chicks. Later in the dry season, when the weather is warmer, extra care in holding the eggs and in the preparation of the hatching nest must be exercised.

Number of eggs to each hen.—A setting consists of fifteen eggs. This number may be varied according to the size of the hen to be used. During the warm months, seventeen or even eighteen eggs may be safely placed under one hen. In exceptional cases as many as thirty eggs have been placed under a hen with satisfactory results. After the seventh day of incubation the eggs may be tested and the infertiles and those that have dead germs taken out. Three hens may be set at the same time, and after testing and culling out the infertiles and those having dead germs, the remaining eggs may be placed under two hens, and the third one given a fresh supply of eggs.

Testing.—The eggs are generally tested two times, on the seventh and on the fourteenth days of incubation. In the first testing, eggs that appear clear except for a slight floating shadow due to yolk are referred to as "infertiles." These may be eggs that have never been fertilized, or fertilized eggs in which the germ has died so early that it can not be distinguished in testing. The egg that has a spider-like structure inside has a living germ, the dark figure in the centre being the body of the embryo chick, and the radiating lines, the blood vessels. If the germ is dead, it may be recognised by the presence of a dark ring or by the absence of the blood vessels; in most cases the dead germ is stuck to the shell. Doubtful cases should not be removed. At the second testing on the fourteenth day of incubation, the living embryo will nearly fill the egg, while the egg with a dead embryo will appear fairly clear, depending upon the age of the germ when death took place. Hens' eggs will normally hatch 19 to 21 days after placing them under a hen. There may be a few eggs that will hatch a few days later, but these are considered abnormal hatches.

BROODING.

Natural Brooding.

The hen is the practical brooder, except where artificial incubators are used. A tame, quiet, motherly hen should be used. Young tame capons are frequently employed as brooders. Whether capons or hens are used, they and the young brood should be provided with a coop to protect them in bad weather and from animal enemies. A fair sized shady and grassy run for the young chicks is a necessity for successful brooding.

Care And Feeding Of Young Chicks.

The newly hatched chicks should be taken from the nest about twelve hours after the last chick has hatched out of the shell. The first feed should not be given until about two days later. This first feed should be soft and nourishing. The eggs that did not hatch may be boiled hard, chopped fine, and mixed with either rice bran, boiled rice, or bread crumbs. This feed may be given to the chicks at regular intervals during the first week and interchanged with harder though finely ground feeds until the chicks are large enough to pick up ground grain. Table scraps may be fed with great advantage, providing they are fresh and wholesome. Cleanliness, regularity of feeding, use of feeds rich in protein, as ground snails, *anay*, fish scraps, etc., a plentiful supply of clean, cool water, and a wide, grassy, and shady run are essential requirements in brooding chicks during the first weeks.

Caponizing[5].

The best time to caponize a cockerel is when the comb has become so red that he can be easily distinguished from a female. Under ordinary conditions, only one rooster to every ten to fifteen hens is necessary, and the surplus cockerels should be caponised so that they can be more profitably raised and marketed. A capon grows larger, yields tenderer and juicier meat than a rooster. Also a capon is much less troublesome and less restless than a rooster and does not annoy the pullets. Roosters are not only smaller than capons but produce dry, tough, and very fibrous flesh.

Caponizing by the native method[6] is slower and more dangerous than the more scientific process, and the percentage of mortality is considerably higher. The essential instruments used for the scientific operation are a knife, a pair of spreaders, a hook, a probe, and a spoon or a pair of forceps.[7]

The testes are removed through a slit made between the last two ribs of the bird, after the feathers in this region have been plucked off. When the slit is properly made no sewing is necessary as the skin of the fowl covers the hole made. It is always safer to remove the testes by making two slits, one on each side of the bird. It is advisable for a beginner to first operate upon a cockerel that has been killed for the purpose. Skill and knowledge thus obtained will lessen the number of deaths from the operation. Birds that die as a result of the caponizing operation soon after it is performed are still good for food.

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[5] The process of removing the testes of male birds. A capon is an unsexed male bird.

[6] The testes are removed by the operator's fingers from a hole made in the abdomen of the bird after which the hole is sewed up.

[7] A good set of caponizing instruments can be bought from Botica Boie, Manila, for about P10.00. A set can be made by a silversmith for less than this amount.

If the bird has been properly prepared, that is, fasted for at least twelve hours, an experienced operator can caponize it in three to five minutes. Care should be taken to remove the testes entirely, otherwise, slips will be formed. Newly caponized birds should be given a little soft feed and water. If, a day or two after the operation, the skin of any of the birds is puffed, pricking the skin with a knife or a large needle to let the air out will relieve the trouble. Capons, if properly made, can be marketed with profit around eight months of age. The gains made after this are no longer economical.

How to train a capon to take care of chicks.— If the capon is tame, no special training is necessary. The chicks may be placed under him at night, and the following morning he will take them around like a mother hen. However, it will usually be found necessary to give a capon special training before he can be trusted to look after a brood of chicks.

The first step in the training is to confine the capon in a box so narrow that he cannot turn around and so low that when it is covered with wire netting or slats made of bamboo or wood, he cannot stand, thus forcing him to remain in a sitting position. The capon is kept in this box all the time except when being fed and watered. After a day or two he will learn to sit down at regular intervals. The chicks may then be placed under him at night. Tame capons may be trusted to take care of young chicks after two or three days of training, but if the capon is semi-wild, a week or more may be necessary. It is advisable not to give a capon chicks that are less than one week old. When younger, the chicks are so small and weak that they are likely to be crushed under the capon's feet.

MANAGEMENT OF THE LAYING STOCK.

Signs of Maturity Among Pullets.

The most common signs of maturity in a pullet are enlargement and reddening of the comb and wattles, enlargement of the vent, greater activity and a happier disposition as shown by her cackling a great deal. Small pieces of scab may be seen sloughing off the comb and wattles. These and the earlobes become warm to the touch. The abdomen of pullets coming to maturity expands as a result of the enlargement of the digestive and reproductive organs.

Number of Hens to a Rooster.

Contrary to the general belief, hens will lay without roosters among them. If the eggs are not intended for hatching, no male birds should be allowed to run with the hens, except when they run at large when a rooster is necessary to keep them together and from roaming from the owner's homestead. If fertile eggs are to be produced, there should be at least one rooster for every ten to fifteen hens. There should not be too many roosters in a flock or on a farm as roosters make trouble and even small disturbances in the flock annoy the ever-nervous young hens. Sometimes the presence of too many roosters on the premises cause the production of an unusually large percentage of infertile eggs.

Care Of The Layers.

Laying hens should never be disturbed. There are no more excitable birds than a group of laying hens, and one disturbance in the flock may mean a number of eggs lost and even the death of a number of the hens from broken eggs in the oviduct. The poultry house and its immediate neighbourhood should be kept clean and dry in order that clean eggs may be produced. The poultry house should be cleaned of poultry manure at least once a week. The manure is a good fertilizer and should not be wasted. Poultry raising is a clean occupation if the house and equipment are kept clean. The work often appears dirty and insanitary because the common rules of cleanliness are not observed.

Breaking Up Broodiness.

As broodiness is a maternal instinct, the hens naturally desire to sit after laying a number of eggs—usually not more than a dozen. If it is not desired to hatch these eggs, the broodiness should be broken up so that the hen will not spend time idling. Various methods of breaking up broodiness, as starving the broody hen, dipping her in cool water, applying salt or ground pepper or both on the vent, and various other means have been recommended. These treatments, besides being inhumane, do not always work and the hens so treated do not generally lay again for some time.

When the hens are broody, their ovaries become inactive, and therefore the proper way to break their broodiness is to feed them very well so that they will soon lay eggs. One method, found satisfactory at the College, is to confine the broody hens in a roomy, well ventilated compartment provided with a hard floor made either of bamboo, wooden slats, concrete, or earth packed hard. While confined, the hens are given soft nourishing food, as wet mash. Hens so confined soon after they show broodiness will lose their desire to set after about four days, and will begin to lay again a few days after they are let loose or returned to the pens.

DISEASES.

The presence of a number of poultry diseases should not be considered as a deterrent in the raising of chickens, as the diseases can be largely controlled. If strict sanitation is observed danger from poultry diseases will be minimized. Cleanliness, regular supply of nutritious, wholesome feeds, plenty of clean cool water, and good housing facilities including a large grassy and shady run will help to keep away poultry diseases. Only the most common poultry diseases are given in this paper.

Roup.

Roup (*sipon*, Tag.) is distinguished by a sticky discharge from the nostril, and in most cases, this discharge collects in the nostrils where it forms a cheesy mass causing a tumor-like swelling on the face beneath the eyes. During the early stages, the discharge is thin and watery, but becomes thick after a few days. The appetite decreases, the wings droop, and in general appearance, the bird shows signs of depression and illness. Young fowls are more susceptible to this disease than mature ones. Prevention is the best treatment. Only expensive birds need the individual treatment of cleansing the nostrils of the discharge and dipping the entire head for 20 to 30 seconds in a weak solution either of creoline or of potassium permanganate.

Chicken Pox.

Chicken pox (*bulutong*, Tag.) is distinguished by the wartlike knots found on the unfeathered portions of the head. Sometimes the whole head is inflamed, and the eyelids of the bird affected become swollen and stuck together. In the Phillippines, it is mostly young birds that are affected, but in other countries, mature fowls generally contract the disease. Recovery without treatment may take place within two weeks, but this happens only with strong birds. The nodules may be burned with a red-hot wire, or painted with a strong solution of tincture of iodine after removing the crust. Isolate the affected birds from the healthy individuals to prevent the spread of the disease. Feed the chickens very well to keep them healthy and vigorous.

Avian Diphtheria.

Avian diphtheria (*sampaga*, Tag.) is distinguished by the presence of a membranous deposit on the mucous surface of the nostrils, eyes, mouth, throat, trachea; or bronchi. This deposit is at first thin and light in colour, but becomes thicker and firmer later. It has the appearance of a flower, hence its local name *sampaga*. When it is removed, the surface beneath is seen to be inflamed, ulcerated, and bleeding. Local treatment of the diseased part is recommended. Remove the membranous deposit and paint the exposed tissue with either tincture of iodine, silver nitrate, or a strong solution of hydrochloric acid. Experienced keepers of game-cocks claim that they have had success by treating these raw tissues with the solution resulting from putting a copper coin in vinegar and allowing it to stand over night.

Fowl Cholera.

The excrement of the birds affected with fowl cholera (*peste*, Spanish) is highly coloured yellow and green, sometimes occurring together and sometimes separately. The sick bird isolates himself from the flock, the feathers are roughened, and the wings droop. Generally there is severe diarrhoea. In some cases, the bird affected lives several days, but in acute cases, it dies within twelve hours after infection. Apparently healthy birds may go to roost in the evening and be found dead the following morning. Individual treatment is not advisable. Kill the sick birds immediately in order to prevent further trouble.

External Parasites.

Lice (*kuto*, Tag.) and mites (*hanip*, Tag.) do more harm to young birds than to the mature ones. These parasites so reduce the birds' vitality as to make them very susceptible to other troubles. Sitting hens are very much bothered by mites, and sometimes they leave the nests before the eggs are hatched. Cleanliness, dryness, good ventilation, and plenty of sunlight are very good preventives for the rapid increase of mites. A dust bath will help fowls very much in overcoming lice infestations. Sanitary surroundings and a wide dry range are the best preventives of external parasites. The presence of lice can easily be detected by looking for them either under the wings or around the vent.

Scaly Legs.

Scaly leg is a disease caused by mites burrowing under the scales of the legs and feet. The legs become very much enlarged and roughened, and in serious cases, the bird affected may become lame. The disease may be treated by brushing off the crusts after soaking the legs in warm soap suds and coating the cleaned portions with creolated vaseline. Dipping the legs in kerosine and coconut oil, mixed half and half, is another treatment that has proved successful. The spread of this disease may be prevented by not using infested hens for hatching eggs.

Intestinal Worms.

The most common intestinal worms are the round worms (*bulati* Tag.), long, white, cylindrical worms, varying from a centimeter or less to more than ten centimetres in length, and the tape worms (*apad*, *Tag*) which are long, flat, white, segmented worms. Intestinal worm infestations do not seem to cause mature fowls to suffer very much, but young chickens so affected become very thin, dull, and sleepy. Round worms if present in large numbers sometimes form into rather large balls and obstruct the passage of food materials through the intestines. Green tobacco leaves or tobacco dust are good expellers of round worms. The tobacco leaves are chopped fine and soaked in water, and the liquid used in wetting mash feed. For tape worms, rotation of the grounds at least once every two or three years is one of the best preventive measures known.

Animal Enemies.

Losses due to animal enemies as the *bayawak*, snakes, hawks, crows, *alimos*, dogs and rats, are some of the main causes of failure in poultry raising. The flock should be well protected and guarded against these. The use of traps with dead chickens as bait is very effective against bayawak and rats. Scare-crows and a shot gun will help drive hawks and crows away. No dogs which have the habit of chasing and killing chickens should be turned loose in the poultry yards. Finally, places where wild animals can hide themselves during the day should be cleared off.

INFLAMMATION.

By S. N. Bruce, M.V.D.

Acting Government Veterinary Surgeon.

Inflammation is a hyper-nutrition of a tissue. It is described by Dr. Agnew, the surgeon, as "a double-edged sword, cutting either way for good or for evil." The increased nutrition may be moderate and cause a growth of new tissue, a simple increase of quantity at first, or it may produce a new growth differing in quality; or it may be so great that, like luxuriant, over-grown weeds, the elements die from their very haste of growth, and we have immediate destruction of the part. According to the rapidity and intensity of the process of structural changes which takes place in an inflammed tissue, inflammation is described as acute or chronic, with a vast number of intermediate forms. When the phenomena are marked, it is termed sthenic; when less distinct, as the result of a broken-down and feeble constitution in the animal, it is called asthenic. Certain inflammations are specific, as in strangles, the horsepox, glanders, etc., where a characteristic or specific cause or condition is added to the origin, character of phenomena, or alterations which result from an ordinary inflammation. An inflammation may be circumscribed or limited, as in the abscess on the neck caused by the pressure of a collar, in pneumonia, in glanders, in the small tumors of a splint or a jack; or it may be diffused, as in severe fistulas of the withers, in an extensive lung fever, in the legs in a case of grease, or in the spavins which affect horses with poorly nourished bones. The causes of inflammation are practically the same as those of congestion, which is the initial step of all inflammation.

The temperament of a horse predisposes the animal to inflammation of certain organs. A full-blooded animal whose veins shows on the surface of the body, and which has a strong, bounding heart pumping large quantities of blood into the vascular organs like the lungs, the intestines, and the laminae of the feet, is more apt to have pneumonia, congestive colics, and founder, than lymphatic, cold-blooded animals which have pleurisies, inflammation of the bones, spavins, ringbones, inflammation of the glands of the less vascular skin of the extremities, greasy heels, thrush, etc.

Young horses have inflammation of the membranes lining the air passages and digestive tract, while older animals are more subject to troubles in the closed serous sacs and in the bones.

The work to which a horse is put (saddle or harness, speed or draft) will influence the predisposition of an animal to inflammatory diseases. As in congestion, the functional activity of a part is an important factor in localizing this form of disease. Given a group of horses, mules or asses exposed to the same draft of cold air or other exciting cause of inflammation, the one which has just been eating will be attacked with an inflammation of the bowels; the one that has just been working so as to increase its respiration will have an inflammation of the throat, bronchi, or lungs; the one that has just been using its feet excessively will have a founder or inflammation of the laminae of the feet.

Causes Of Inflammation.

The direct cause of inflammation is usually an irritant of some form. This may be a pathogenic organism—a disease germ—or it may be mechanical or chemical, external or internal. Cuts, bruises, injuries of any kind, parasites, acids, blisters, heat, cold, secretions, such as an excess of tears over the cheek or urine on the legs, all cause inflammation by direct injury to the part. Strains or wrenches of joints, ligaments, and tendons, cause trouble by laceration of the tissue. Inflammation of the internal organs is caused by irritants as above, and by sudden cooling of the surface of the animal, which drives the blood to that organ which at the moment is most actively supplied with blood. This is called repercussion. A horse which has been worked at speed and is breathing rapidly is liable to have pneumonia, if suddenly chilled, while an animal which has just been fed is more apt to have a congestive colic, if exposed to the same influence, the blood in this case being driven from the exterior to the intestines, while in the former it was driven to the lungs.

Symptoms.

The symptoms of inflammation are, as in congestion, change of colour, due to increased supply of blood; swelling from the same cause, with the addition of an effusion into the surrounding tissues; heat, owing to the increased combustion in the part, pain due to pressure on the nerves, and altered function. This latter may be augmented or diminished, or first one and then the other. In addition to the local symptoms, inflammation always produces more or less constitutional disturbance or fever. A splint or small spavin will cause so little fever that it is not appreciable, while a severe spavin, an inflamed joint, or pneumonia may give rise to marked fever.

The alterations in an inflamed tissue are first those of congestion, distention of the blood vessels, and exudation of the fluid of the blood into the surrounding fibres. With a mare, however, complete stagnation of the blood; fibrin, or lymph, a plastic substance is thrown out as well, and the cells, which we have seen to be living organisms in themselves, no longer carried in the current of the blood, migrate from the vessels and, finding proper nutriment, proliferate or multiply with greater or lesser rapidity. The cells which lie dormant in the meshes of the surrounding fibers are awakened into activity by the nutritious lymph which surrounds them, and they also multiply. Whether the cell in an inflamed part be the white ameboid cell of the blood or the fixed connective tissue cell embedded in the fibers, it multiplies in the same way. The nucleus in the centre is divided into two, and then each again into two, *ad infinitum.* If the process is slow, each new cell may assimilate nourishment, and become like its ancestor, an aid in the formation of new tissues; if, however, the change takes place rapidly, the brood of young cells have not time to grow or use up the surrounding nourishment, and, when half-developed, they die, destruction of tissue takes place, and pus or matter is formed, a material made up of the imperfect dead elements and the broken down tissue. Between the two there is an intermediate form, where we have imperfectly formed tissues, as in "proud flesh," large soft splints, fungus growths, greasy heels and thrush.

Whether the inflamed tissue is one like the skin, lungs or intestines, very loose in their texture, or a tendon or bone, dense in structure, and comparatively poor in blood vessels, the principle of the process is the same. The effects, however, and the appearance may be widely different. After a cut on the face, or an exudation into the lungs, the loose connective tissue and multiple vessels allow the proliferating cells to obtain rich nourishment; absorption can take place readily, and the part regains its normal condition entirely, while a bruise at the heel, or at the withers, finds a dense, inextensible tissue, where the multiplying elements and exuded fluids choke up all communication, and the part dies (necrose), from want of blood and cause a serious quittor, or fistula. This effect of structure of a part on the same process shows the importance of a perfect knowledge in the study of a local trouble, and the indispensable part which such knowledge plays in judging of the gravity of an inflammatory disease, and in formulating a prognosis or opinion of the final termination of it. It is this which allows the veterinarian, through his knowledge of the intimate structure of a part and the relations of its elements, to judge of the severity of a disease, and to prescribe different modes of treatment in two animals for troubles which appear to the less experienced observer to be absolutely identical.

Termination Of Inflammation.

Like congestion, inflammation may terminate by resolution. In this case the exuded lymph undergoes chemical change, and the products are absorbed and carried off by the blood vessels and lymphatics, to be thrown out of the body by the kidneys, liver, the glands of the skin, and the other excretory organs. The cells, which have wandered into the neighbouring tissues from the blood vessels, gradually disappear or become transformed into fixed cells. Those which are the result of the tissue cells, wakened into active life, follow the same course. The vessels themselves contract, and having resumed their normal calibre, the part apparently re-assumes its normal condition; but it is always weakened, and a new inflammation is more liable to reappear in a previously inflamed part than in a sound one. The alternate termination is necrosis, or mortification. If the necrosis, or death of a part, is gradual, by small stages, each cell losing its vitality after the other in more or less rapid succession, it takes the name of ulceration. If it occurs in a considerable part at once, it is called gangrene. If this death of the tissue occurs deep in the organism, and the destroyed elements and proliferated and dead cells are inclosed in a cavity, the result of the process is called an abscess. When it occurs on a surface, it is an ulcer, and an abscess by breaking on the exterior becomes then also an ulcer. Proliferating and dying cells, and the fluid which exudes from an ulcerating surface and the debris of broken-down tissue is known as pus, and the process by which this is formed is known as suppuration. A mass of dead tissue in a soft part is termed a slough, while the same in bone is called a sequestrum. Such changes are especially likely to occur when the part becomes infected with micro-organisms that have the property of destroying tissue, and thus causing the production of pus. These are known as pyogenic micro-organisms. There are also bacilli that are capable of multiplying in the tissues and so irritating them as to cause them to die (*necrose*) without forming pus.

Treatment.

The sick animal should be placed in a well-ventilated box stall, away from other animals. To reduce the temperature, the safest and simplest plan is to inject large quantities into the rectum. Antipyrene may be used with alcohol or strychnine. Derivatives, in the form of essential oils and mustard poultices, baths of alcohol, turpentine and hot water, after which the animal must be immediately dried and blanketed, serve to waken the animal up from the stupor and relieve the congestion of the internal organs. This treatment is especially indicated when complication by congestion of the lungs, intestines, or of the brain is threatened. Quinine and Salicylic acid in 1-dram doses will lower the temperature, but too continuous use of quinine in some cases increases the after depression. In cases of severe depression and weakness of the heart, digitalis can be used with advantage. At the end of the fever, and when convalescence is established, alcohol in one-half pint doses and good ale in one pint doses may be given as stimulants; to these may be added one dram doses of turpentine.

List of Rice Padi cultivated and under Experimental Test at the Experimental Fields, Botanic Gardens.

Yields of Padi for 4 years 1921, 1922, 1923, 1924. Bags of 140 lbs. per acre.

Demerara Varieties.

VARIETY.	YIELD 1921.	YIELD 1922.	YIELD 1923.	Yield 1924.	MEAN 4 YEARS.
Hill 6	25. 36	28.57	27.18	23.61	26.18
,, 7	27.12	31.63	32.20	24.15	28.77
Hybrid 35	27.68	25.26	24.64	16.22	23 45
Lowland 75	27.12	32.49	32.03	23.38	28.75
,, 76	29.99	29.48	27.10	15.31	25.47
,, 77	28.87	30.94	29.26	25.73	28.70
,, 78	24.98	32.97	31.01	26.64	28.90
, 79	29.52	29.53	29 25	26.18	28.62
Demerara Creole	5.31	30 85	29.78	24.64	27.64
Berbice ,,	10.00	8.93	22.23	25,86	16.75
Mackenzie City	...	...	19.52	14.52	(2) 17.02
Nismes	...	...	...	29.29	...

Surinam Variety.

Suriname Creole	30.78	20.00	14.25	24.86	22.47

U.S.A. Variety Agric. Dept.

Blue Rose	8.39	12.95	10.61	1.04	8.25

Ceylon Varieties, Introduced 1922.

No. 3	...	...	3.69	8.65	6.17
No. 9	...	...	20.85	*	...
No. 11	...	...	22.50	24.16	23.33
No. 14	...	...	15.48	19.76	17.62
No. 19	...	...	14.22	14.65	14.43
No. 30	...	...	21.43	*	...
No. 33	...	...	...	1.65	...
Bibili el	...	...	...	7.28	...
Indrasal	...	...	...	13.42	...
Sulai	...	...	...	8.02	...
N.N. 2/8	...	...	...	10.32	...
H.J. 16	...	...	...	14.88	...
Honder-a-wella	...	...	...	2.86	...

* Thrown Out.

REPORTS ON A SUSPECTED OUTBREAK OF INFECTIOUS MOSAIC DISEASE AMONG CERTAIN CANES IN THE COLONY.

By R. A. Alston, A.R.C.S., B.Sc.,
Assistant Government Botanist and Mycologist.

No I.

Botanic Gardens,
Georgetown,
24th October, 1924.

On the 7th October, 1924, the Superintendent of the Sugar Planters' Experiment Station drew my attention to some canes growing at Pln. Sophia the leaves of which exhibited a chlorotic mottling. The form of the chlorosis—that is its even distribution over the whole leaf, and its occurrence in some instances on young leaves—coupled with the stunted appearance of the plants suggested it might be a case of infectious chlorosis, i.e., mosaic disease. However, as at that time, I was under the impression that the canes in question were a lot of locally raised seedlings, and it would therefore be impossible to account for any source of infection, this hypothesis was held to be untenable. Subsequently it was learnt that these canes were an extension of a consignment of B.H. 10 (12) which had been imported from Barbados in December, 1920, the year in which mosaic disease had been recognised as being present in that Island. This information provided some support for my provisional diagnosis but by no means confirmed it. Nevertheless I felt justified in advising the Superintendent to take precautionary measures and recommended that the B.H. 10 (12) and Ba. 6032 (the latter exhibited no cholorsis but had been imported in the same consignment) should be eradicated from Pln. Sophia. Both these canes had previously been abandoned (after cutting as first ratoons) owing to their poor growth. At the same time I arranged for some of the B.H. 10 (12) to be replanted in a suitable isolation area so as to provide material for a more critical examination of the symptoms.

A further examination of the suspected cane at Pln. Sophia was made prior to its eradication. It was found that while about 80% of the stools exhibited the typical mottling, in less than 10% of the cases was it to be observed on the youngest leaves. There was no evidence of any spread either on to the surrounding canes or on to the weed grasses, among which was one species (*Echinochloa colonum*) known to be susceptible to cane mosaic.

I have since visited sixteen estates which at some period during the last three years have received consignments of this particular lot of cane from the Experiment Station. Field inspections have already been carried out in eight instances. The form of chlorosis under consideration was found to be present to a varying extent on the B.H. 10 (12) in seven of these cases, on a wide range of soils. On the remaining estate it could not be observed. In only one cultivation was a similar mottling seen on Ba. 6032. In no instance has there been any indication of spread to neighbouring varieties of cane or to weed grasses. Among the latter, four species (*Echinochloa colonum*, *Syntherisma sanguinalis*, *Syntherisma digitata* and *Eleusine indica*), which were not uncommonly encountered, are known to be susceptible to cane mosaic.

The evidence in regard to the growth character of these canes is, at present, rather inconclusive. Barbados seedlings as a whole have a reputation in this Colony for poor ratooning qualities. In most instances where the suspected B.H. 10 (12) was seen to be growing well it was found that they were plant canes. Where a bad case of stunting in plant canes was observed there was strong evidence that soil conditions were contributing to the effect. The general impression would seem to be that ratoons lacked vigour and made poor growth. On two estates (not included in the eight cited above) the B.H. 10 (12) in question had been thrown out of cultivation some time ago on account of this feature. A case of severe stunting in a field of six months old first ratoons was accompanied by a high percentage of mottling. In two instances where the experience has been that B.H. 10 (12) ratoons well, the canes were found to be free from chlorosis, and it was definitely established that they had been derived from an earlier importation from Barbados and not the one under suspicion.

Summary and Discussion.

A considerable proportion of consignment of B.H. 10 (12) imported into this Colony from Barbados in December 1920 is affected with a chlorosis, which takes the form of a pale green mottling of the leaves typically distributed evenly over the whole leaf surface but at times confined to one side of the midrib. It occurs most frequently on the more mature leaves but in a small percentage of cases can be found on the youngest leaves.

This chlorosis would appear to be capable of transmission by vegetative reproduction through successive generations for it has appeared in progeny (derived from the original consignment) in various parts of the Colony on what must, at this stage, be regarded as a fairly wide range of soils. It is not an inherent characteristic of this particular variety for many plants of B.H. 10 (12) have been observed which are entirely free from it.

There is some rather inconclusive evidence that the effects of this chlorosis are cumulative and may result in a considerable loss of vigour in ratoon crops.

A general consideration of these symptoms renders them somewhat suggestive of infectious chlorosis (mosaic disease). This disease is characterised by a peculiar pale green or yellow mottling of the leaves. The pattern produced by the chlorotic areas on the leaf is usually constant for any one variety of cane, but varies within such wide limits with the different varieties that it is a character of doubtful diagnostic value. In typical cases the mottling is always present on the youngest leaves, (though it may be absent on some of the older ones) and involves the entire leaf surface. Speaking broadly it is in this manner that the leaf symptoms of infectious chlorosis differ from those which accompany some types of chlorosis attributed to defective nutrition, in which cases the mottling tends to be localised and is not, as a rule, distributed over the whole leaf. Another form of mottling, that occasioned by the attacks of insects or fungi, is more easily distinguished, for this generally makes its appearance on the older leaves, and the tissue in the affected areas eventually dies and becomes discoloured.

The fundamental point of difference, however, between mosaic disease and other forms of chlorosis is that the former is infectious; can be reproduced vegetatively; and is not influenced by variations in soil character. It can be transmitted in the field from an infected cane plant to a healthy one, or to certain weed grasses, by means of a sucking insect—the corn aphis (*Aphis maidis*), and, providing favourable conditions obtain, spread in this way may be extremely rapid. Infected tops give rise to infected plants, and thus by planting infected material a further extension of the disease can occur. The effects of the disease are cumulative, and result in a progressive decline in vigour and a consequent reduction in yield.

The entire absence at the moment, of any indication of spread of the chlorosis from the affected stools of B.H. 10 (12) to neighbouring canes or weed grasses is strong evidence in support of the view that the mottling is of the non-infectious type, but cannot however be regarded as proof of this. For the aerial transmission of mosaic disease the presence of a suitable vector is essential. Whilst sufficient data is not yet available to justify the expression of any definite opinion there is reason to suppose that *Aphis maidis* is somewhat uncommon in cane cultivations in this Colony. The absence of its favourite host plant—corn (maize)—in these localities might conceivably be held to account for this state of affairs.

A satisfactory solution to the problem of the nature of this chlorosis is only to be looked for as the result of careful investigation. The Government Economic Biologist and myself have initiated a series of infection experiments whereby, by employing both insects and artificial means of transmission, we hope to be able to secure evidence which will determine whether it is of an infectious nature or not.

Recommendations.

In view of the absence of any evidence of spread of the chlorosis from affected plants of B.H. 10 (12) to neighbouring canes or weed grasses I am of the opinion that there is, at the moment, no reason for regarding the situation with alarm.

The formulation of the following recommendations is influenced by the circumstances that the chlorosis, whatever its cause, is an abnormal condition in the plant which, by its effect on the photosynthetic activity of the leaves, must reduce yield, and one which would appear to be capable of being transmitted through successive generations by vegetative reproduction.

I would not recommend, for the present, any extension of the acreage under this cane. If, however, it is felt desirable, when fields are being replanted, to retain it in cultivation, care should be taken to plant tops only from chlorosis—free stools, and, so as to permit of the necessary inspection, these should be drawn from standing cane.

Fields of young cane should be inspected periodically, and any stools exhibiting signs of the affection should be dug out and replaced by healthy tops.

On those estates where the area under this cane is exceedingly small and the percentage of affected canes is high, it would appear advisable to carry out complete eradication after cutting, and (again providing it is desired to keep this variety in cultivation) it is suggested that supplies of chlorosis-free tops could be obtained from estates where the B.H. 10 (12) is, at present, unaffected.

A careful watch should be kept for any signs of spread of the chlorosis on to neighbouring canes or weed grasses, and if this is suspected, it should at once be reported. As a precautionary measure, no corn (maize) should be permitted to grow in the vicinity of cane cultivations.

No II

Botanic Gardens,
Georgetown,
5th June, 1925.

Since the above was written, time has made possible a more critical study of the disease, and, as the result, I am now able to state that the chlorosis under consideration is not infectious, or that, in other words, the disease is not mosaic disease. The evidence on which this conclusion has been based is summarised below.

(*a*) All attempts to transmit the chlorosis to healthy cane and corn plants, utilising both insect and artificial means of inoculation, have been unsuccessful. The insect transmission experiments, begun by the Government Economic Biologist, were at his departure on leave, continued, under my supervision by his Assistant. In these experiments, corn aphids (*Aphis maidis*), which are proved vectors of cane mosaic, were bred, under cages, on mottled plants of B.H.10 (12), and transferred, after suitable periods, to healthy young corn plants, the latter being then covered with muslin bags. The plants thus inoculated have completed their life-cycles without developing any symptoms of mosaic disease. (In a similarly conducted experiment, but using aphids bred on plants known definitely to be affected with mosaic disease, Brandes (1) records a 50 per cent. infection of the corn plants, sixteen days after inoculation).

In the artificial transmission experiments, juice from the immature tissue of the apical bud of mottled plants of B.H.10 (12) was injected by means of a hypodermic syringe into the region of the growing point of healthy corn and cane plants. It was so arranged, by inserting small pieces of the immature tissue into the barrel of the syringe, that the expression and injection of the juice was performed in one process. (A previous mechanical expression of the juice in bulk was to be avoided, for it has been shown (2) that the virulence of infectious juice is adversely affected by exposure to the air). A clean and recharged hypodermic was used for each inoculation, at which not less than 0.1 c.c. of freshly expressed juice was injected. In cases where the needle became choked, the inoculation was repeated until a satisfactory injection had been obtained. All the corn plants thus treated, came to maturity without developing any symptoms of mosaic disease. The cane plants have also remained healthy.

(*b*) The lack of evidence of spread of the chlorosis in the field from affected stools of B.H.10 (12) to the surrounding canes, or to weed grasses, is neither to be accounted for by the absence of a suitable vector, for it has been determined that *Aphis Maidis*, although somewhat infrequent, is, nevertheless to be found in cane cultivations, particularly on certain weed grasses, nor by the immunity of the adjacent canes, or weed grasses, for, of the former, the variety occuring most frequently (D.625) has proved susceptible to cane mosaic elsewhere and of the latter, four species commonly encountered (*Echinochloa colonum*, *Syntherisma digitata*, *Syntherisma sanguinalis*, and *Eleusine indica*) are also known to be susceptible to this disease.

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(1) Brandes, E. W. Jour. Agr. Research, v. 19, No. 10 p. 517-522. 1920.

(2) Brandes. E. W. Jour. Agr. Research, v. 19, No. 3 p. 131-138, 1920, *and* v. 24, No. 3 p. 247-262. 1923.

(*c*) In typical cases of mosaic disease, as has already been mentioned, the mottling is always present on the youngest leaves In my previous report it was observed that, in less than 10 per cent. of the cases at Pln. Sophia did the immature leaves exhibit the chlorosis. A more general estimate based on the survey of several estates puts this figure at not more than 5 per cent.

(*d*) The mottling does not, as a rule, make its appearance on the leaves of plants derived from affected cuttings until the shoots are from three to five months old, and then its occurrence may be infrequent. A careful count of a plot of plant canes propagated from affected tops made five months after planting, showed that only 9 per cent. of the stools had developed the symptoms of chlorosis. On the other hand, in a plot of five months old first ratoons, 55-60 per cent. of the stools were aflected. However, from the evidence supplied by the observation of plant canes, it had been concluded that my former statement that the chlorosis 'would appear to be capable of transmission by vegetative reproduction . . . . . . ' is incorrect.

(*e*) The pattern produced on the leaf by the chlorotic areas bears no resemblance to that developed in authentic cases of mosaic disease on the leaves of B.H. 10 (12) grown in Barbados. This comparison was made by means of preserved material kindly supplied by the Director of Agriculture, Barbados.

In the light of more recent knowledge of the disease, the recommendations which were formulated last October for its control would now seem to be vitiated, for they were largely based on the tentative assumption that the disease could be transmitted in affected cuttings. When these recommendations were made, sufficient time had not elapsed to allow this hypothesis (which had its origin in the fact that the disease had appeared indiscriminately, in progeny derived from the orginal importation, in widely separated areas, on a varied range of soils) being put to the test of experiment, but this has since been done, and it appears to be untenable.

The evidence now available makes it seems probable that this chlorosis is the outcome of some nutritional disturbance. That it develops in canes growing on a wide range of soils should not, perhaps, be held to indicate that the predisposing factor is one unconnected with soil condition, but rather one that is common to soils which may otherwise differ. At this stage of my enquiry it is not possible to specify this common factor. On several occasions it has been brought to my notice that B.H.10(12), although affected with chlorosis, yields juice containing more sucrose per gallon than that of any other variety grown in the Colony, and this fact has been adduced as evidence that the chlorosis, if not actually beneficial, is at least harmless. It is hardly necessary to point out that this contention is fallacious. Any normal autophyte, such as sugar cane, depends for its existence on the photosynthetic activities of the green colouring matter (the chlorophyll) of its leaves. It is solely by virtue of properties peculiar to this substance, chlorophyll, that a green plant is able to utilise the energy emitted by the sun for the initiation of the synthesis of those complex organic compounds in whose absence growth, and eventually life, ceases. It follows, therefore, that any circumstance resulting even in the partial loss, or destruction, of chlorophyll in the leaf must react unfavourably on growth. The pale green areas which give the mottled appearance to leaves affected with chlorosis, are areas which are deficient in chlorophyll and a leaf so affected necessarily operates at a lower state of efficiency than one which is healthy.

That the yield of sucrose per gallon of juice of chlorosis affected B. H.10 (12) is higher than that of other varieties of cane, which nevertheless are healthy, shows that in spite of the chlorosis, this seedling retains its inherent tendency to store comparatively large quantities of sucrose in its stem. Although it does not inevitably follow that in the case of chlorosis-free B. H.10 (12) the yield of sucrose *per gallon* would be increased—but it is not likely to be diminished—yet it is certain that, other things being equal, the yield of cane, and of sucrose, *per acre* would be appreciably improved.

Whilst this cane continues to give returns which compare favourably with the varieties more generally grown it will no doubt be retained in cultivation, and the area it occupies even extended, in spite of its being extremely subject to chlorosis. Whether these favourable returns will be maintained in later ratoon crops, or whether, as has already occurred on some estates, there will be a rapid diminution in yield, is a matter for consideration. When the history of the early Barbados seedlings in this Colony is reviewed it would not appear advisable to place too much reliance on this particular one, and, furthermore, it is suggested that the continued vegetative propagation of a plant affected with chlorosis is likely to be accompanied by a progressive loss in vigour.

PRACTICAL HINTS FOR FARMERS.

By E. M. MORGAN, Resident Agricultural Instructor, Berbice.

The long hoped-for drainage of the coastlands is now being solved and a timely warning to our farmers should prove most invaluable.

The proper method and attention which is necessary to various crops planted, is so often absent, that our returns in yield are compelled to be poor. Drainage having been established, it is now a most opportune time to regain our laurels, if we are to succeed in building up a prosperous peasantry. We must, with co-operative measures for securing success, strive to produce the best which the land is always ready and so willing to give.

Cacao, coffee, coconuts, cotton, castor-oil, fruits, ground-nuts and arrow-root are the principal crops now exercising the minds of our farmers; but whatever our cultivation is, we must be prepared to be guided by the right principles and learn for the future benefits, that nothing will save time in the growth of plants like the careful cleaning,. culture, and nourishment if need be, of the soil in which they must perforce spend their whole lives. The long life of plants, their value in a state of maturity and the worth of prunings and thinnings at various stages, must all appeal to the farmer to give them a fair and liberal start in good, sweet and clean soil. In the struggle for life which most of the plants above named are forced to occupy, the survival of the fittest seldom proves that the plants were the fittest for the position selected, or preparation provided for them. In the case of trees the culture of the soil here advised is the old plan of digging out the holes for the plants several weeks before actual planting takes place. In doing this the holes and the earth on their sides if kept free from accumulating weeds, will frequently be broken up during the season by atmospheric conditions, therebygiving a sufficiently mellow, sweet, warm soil to entice the roots to a fresh start and vigorous growth in their new quarters.

Where no such preparations have been nor can now be made, an alternative mode of fostering rapid rooting is still available. This consists in giving each tree a few spadefuls of good soil immediately under or over the roots, this will enable them a good start, which will not only save time, but ensure an increase of growing force. A vigorous start always ensures a healthy growth throughout the whole or the major part of the life of a plant; not only is a good preparation the surest means of insuring a healthy and rapid growth, but it is also the best counteraction to any accidents which might naturally occur during growth.

Nurseries, properly attended will accomplish a long-felt want and prove very useful for training plants prior to their taking up, permanent quarters. The small and healthy plants should be chosen in preference to the larger ones, for the shorter the interval between nursery beds and permanent quarters, the better for the well being of their vigorous growth.

In many cases there would be a gain of time by sowing the seed on its permanent site; but the sets must be properly prepared and seedlings kept clean from the first and regularly attended.

HINTS FOR THE HOME.

An old saying states that "the way to a man's heart is through his inner man," and whilst we do not intend to discuss the truth or otherwise of that saying it is well to remember that good house-keeping is essential for happiness in the home. It is necessary for the wife who takes an interest in her home to realize this and to use every endeavour to make those in the home happy and contented. It is only in that way that success lies. Such things as the suitability of various foods and different ways of cooking and serving them should be carefully studied. Monotony in diet is apt to become tiresome and usually results in complete loss of appetite. We hope therefore that the following hints may be found of practical benefit.

RISSOLES, PLAIN AND SAVOURY.—Plain rissoles may be made from yam, sweet potato or cassava. Boil and mash the vegetable; add pepper and salt and parsley chopped (if liked); shape into rissoles; dip in beaten egg; roll in bread crumbs and fry.

Rissoles are the most tasty, though not the most economical way of using scraps of cold meat or fish.

Mince or chop finely any cold meat or fish with seasoning, pepper and salt, mix with vegetables prepared as for rissoles, moisten with a little milk, or a beaten egg, roll in bread crumbs or cassava flour and fry.

Meat or fish cakes are made in the same way, but shaped into cakes and plainly fried.

If a few drops of vinegar be added to the water in which Irish Potatoes are being boiled it prevents them being discoloured and makes them quite white.

Rice, well boiled, is the basis of very many savoury and sweet dishes, besides being in itself one of the best of our locally grown foodstuffs. In cooking, great care should be taken to see that it is thoroughly boiled, a point very often overlooked in the desire to have it "grainy." Nothing is more indigestible than half-cooked rice. The following excellent recipe is recommended:—"Put one cup of thoroughly washed "rice into 5 cups of boiling water, cook from 15 to 20 "minutes in a covered saucepan, then set the saucepan "uncovered in a warm place till all the water is "evaporated. Rice should not be stirred, only shaken. "A little lemon or lime juice added to the water when "the rice is cooking makes it white and seperates the "grains." To many the well know "rice and peas" as a breakfast dish is very popular. For this, almost any kind of peas or beans may be used, green or dried; the dried variety must, of course, be well soaked previously. To a pint of peas, allow a pint of well-washed rice; a pinch of soda if the peas are hard, and only water enough to cook the rice. When the peas are soft, add rice, an onion chopped, and a bit of salt pork and beef cut up or pig-tail cut into small pieces. Salt fish may be used or scalded and pickled shrimps. Boil till all is well done and the rice rather dry. Rice may also be used for puddings, thickening soups, in sweetened or flavoured milk as "rice milk" etc.; while rice flour is often found invaluable in the nursery or sick-room as well as in making many dainty sweet dishes for table. For Blanc-mange and custard, rice flour could easily replace such things as "custard powders," "corn starch," etc., etc.

Banana Tartlets are very nice with afternoon tea. They are so inexpensive and quite easily made. Line small patty-pans with puff pastry, fill with the ripe bananas beaten to a soft pulp, cover lightly with the white of an egg whisked up with a little white sugar and bake in a moderate oven.

Potato Scones are very often a change from the ordinary ones. Boil 1 lb potatoes, place on a well floured board, and roll them with plenty of flour, salt, pepper and one teaspoonful of baking powder, Mix all together with one egg and a little milk. Roll out about one inch thick, and place in a floured frying pan. Fry over a slow fire. When done, split open and butter. Serve hot.

Make a note of these little items—All vegetables grown *under* ground should be put into cold water, and all grown *above* ground in boiling water.

To prevent the Pastry sinking into a Fruit Tart. When bottled fruit is used the pastry often slips into the juice. To prevent this, insert two metal skewers under the top crust, resting on either side of the pie-dish. This can be easily drawn out before the tart is sent to table.

INSTEAD OF EGG FOR COATING—Mix a teaspoonful of custard powder to a thin cream with water. Dip fish, cutlets, etc. in this before coating with bread crumbs, and it will answer as well as a egg.

TO REMOVE STAINS—Grease stains may be removed with ether or chloroform or benzine or petrol. Ink stains by oxalic acid diluted with warm water. A slice of lemon or lime rubbed over the hands is also very good. Mildew on linen, by covering it with table salt and lemon juice, and placing it in the sun. Coffee stains by a mixture of one part of glycerine to nine parts of water, with a little ammonia. Fruit stains should be immersed at once in boiling milk.

SOAP ENDS—To use up odds and ends of soap, put them all in a jar or old saucepan, just cover with water, and leave them in a warm place on the stove until dissolved. Leave till next day, then take it out of the pan and roll it in the hands to form a ball.

A good liniment for colds on the chest is made by mixing 1 part of Oil of Cloves, 2 parts of Oil of Amber and 3 parts of Camphorated Oil or Olive Oil. For young children the latter oil is best.

A SHAMPOOING MIXTURE—Well beat the yolks of two eggs, add a quarter of a pint of lukewarm rain or distilled water, a pinch of powdered borax and the strained juice of half a lemon. It makes the hair delightfully soft.—*Jamaica Agricultural Journal XXVII. No. 3.*

TO REMOVE A SPLINTER—A splinter that has sunk too deep into the flesh to be extracted in the usual way can be drawn out painlessly by means of steam. Nearly fill a wide-mouthed bottle with hot water, place the injured part over the mouth of the bottle, and press lightly. The suction will draw the flesh down and in a few minutes the steam will draw out the splinter.

TO CLEAN BRASS BEDSTEADS—A mixture of vinegar and salt is excellent for cleaning brass bedsteads. Rub it in thoroughly and when the brass is clean and shining wash it with soap and water and dry thoroughly with a cloth on which vaseline has been smeared. This method will prevent the brass tarnishing for some time.

Meteorological Data—April—June 1925.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evapo-ration.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
April ...	4·29	6	7	2	1	...	16	4·71	85·1	75·6	80·3	78·8
May ...	5·96	4	9	2	...	1	16	5·22	85·5	75·5	80·5	78·1
June ...	7·84	7	14	2	2	...	25	4·32	85·2	74·9	80·0	80·1
Totals	18·09	17	30	6	3	1	57	14·25				
Means.	...	...	...	...	...	...	...	...	85·3	75·3	80·3	79·0
Berbice Gardens.												
April ...	2·06	5	6	1	...	...	12	...	87.5	73·6	80·5	78·5
May ...	7·89	1	3	5	1	1	11	...	86·9	73·0	79·9	78.8
June ...	7·23	1	11	2	2	...	16	...	87·1	75·8	81·4	80·9
Totals	17·18	7	20	8	3	1	39	...				
Means.	...	...	...	...	...	...	...	...	87·2	74·1	80·6	79.
Onder-neeming.												
April ...	2·24	2	5	2	...	...	9	...	89·1	74·0	81·5	...
May ...	8·21	3	10	7	1	...	21	...	88.0	73·1	80·5	...
June ...	13·21	...	10	3	5	1	19	...	87·8	73·7	80·7	...
Totals	23·66	5	25	12	6	1	49	...				
Means.	...	...	...	...	...	...	...	...	88·3	73·6	80·9	...
Mora-whanna.												
April ...	1·93	6	8	...	...	...	14	...	...	...	...	...
May ...	5·73	7	9	5	...	...	21	...	...	...	...	...
June ...	5·36	9	13	3	...	...	25	...	...	...	...	...
Totals ...	13.02	22	30	8	...	...	60	...	...	...	...	...

ATTENDANCES AT THE DISTRICT GARDENS

Year.		Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912	...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913	...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914	...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915	...	1,123	1,006	769	59	503	339	401	4,206
1916	...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917	...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918	...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919	...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920	...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921	...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922	...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923	...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924	...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first six months of 1925.

The corresponding figures for the same period during previous years and the average for the same period for seven years previous to that are added for convenience of comparison.

Product.	*Average 1916-22.*	*1923.*	*1924.*	*1925.*
Balata, cwts. ...	2,974	2,846	4,073	3,330
Cattle-food (Molascuit) tons	768	210	434	692
Cacao, cwts. ...	12	None	None	None
Cattle, head ...	172	556	199	357
Charcoal, bags ...	23,680	21,594	22,087	16,887
Citrate of Lime, cwts.	114	None	None	None
Coconuts, thousands	1,362	1,195	982	603
Coconut Oil, gals. ...	11,772	15,729	12,192	14,209
Copra, cwts. ...	775	2,581	11,798	7,670
Coffee, cwts. ...	3,047	4,234	4,475	3,681
Essential Oil of Limes, gals. ...	105	None	None	81
Firewood, Wallaba, etc., tons	4,186	3,904	3,625	3,476
Gums, lbs. ...	1,797	1,155	None	None
Hides, No. ...	2,432	2,591	5,254	5,342
Kola-nuts, cwts. ...	2	None	None	None
Lime Juice, gals. ...	3,795	2,457	3,226	2,479
Lumber, ft ...	93,023	53,608	75,644	44,288
Molasses, gallons ...	32,486	14,881	123,388	503,502
Pigs, No. ...	153	145	242	516
Railway sleepers, No.	6,773	2,456	9,000	23,515
Rice, tons ...	5,660	2,928	2,197	3,580
Ricemeal, tons ...	20	None	None	None
Rubber, cwts. ...	42	3	3	None
Rum, gallons ...	1,672,005	181,126	449,865	725,522
Sheep, head ...	30	11	17	6
Shingles, thousands	1,134	546	572	1,077
Sugar, tons ..	39,533	45,972	41,125	41,248
Timber, cub. ft. ...	63,380	74,464	80,533	134,535

BRITISH GUIANA AT WEMBLEY.

DUKE AND DUCHESS OF YORK VISIT B.G. BUILDING.

On June 9th the Duke and Duchess of York paid a visit to the British Guiana Building, where they were met by Colonel Cecil May and Major Everington, who conducted them round the Pavilion. Their Royal Highnesses spent about twenty minutes, particularly admiring the diamond, bauxite and aluminium exhibits, and walked through the cleverly arranged "jungle." Before leaving the Duke paid a tribute to the coolness of the building on such a tropical afternoon. Colonel May, Major Everington and Mr. J. Mullin, Assistant Commissioner of Lands and Mines, were presented to the Duke and Duchess who showed considerable interest in the Indian Hut, and after admiring the Kyk-over-al, passed on to the pyramid of Demerara crystals. This exhibit is surrounded by seedling canes propagated by the Department of Science and Agriculture of British Guiana, about the work of which the Duke asked a number of questions. The realistic representation of the fauna and birds of the Colony excited the attention of the Royal visitors, who were also keenly interested in the ringtailed monkeys, and expressed surprise on being shown a tree porcupine which neither had seen before. After examining the display of diamonds lent by Messrs. E. A. P. and A. Triefus, they paused at the bauxite exhibit, where they were much amused on being informed that bauxite exports from British Guiana comprised more than one-tenth of the whole world's supply, for, during their tour of Wembley they had been told by one of the other Colonies, in the African Section, that that was the only Colony in the whole of the British Empire which could supply bauxite, and the Duke laughingly told Major Everington to tackle the African people about it, and "tick them off" for their terminological inexactitude.—*The West Indian Committee Circular.— Vol XL. No. 697.*

JOURNAL

OF THE

BOARD OF AGRICULTURE

OF

BRITISH GUIANA.

VOL. XVIII. OCTOBER, 1925. No. 4

EDITORIAL.

In presenting the October issue to our readers we have endeavoured to include subjects covering a wide range in order that as many branches of agriculture as possible may benefit. Once again we have pleasure in publishing an article from the pen of Mr. Maurice Bird, who certainly sets an example to many of our local agriculturists who could with little trouble to themselves contribute articles to our Journal which would be of general benefit. We hope his example will be followed in the near future. Mr. Bird's article on the Withering of Cane is the result of research work carried out by him on two Estates of Berbice and is another illustration of plant diseases being directly traceable to the lack of the ready availability of certain constituents of plant food necessary for healthy growth. It is interesting to record that experiments carried out by our present Director in 1913, pointed to similar conclusions now confirmed by Mr. Bird, an extract of which is published in the present issue under "The Evaporation of Soil Water."

Attention is directed to the fact that following a visit to Trinidad by representatives of the Empire Cotton Growing Corporation, a Cotton Research

Station will shortly be established in that Colony. That this is a step in the right direction there can be no doubt, and it is gratifying to note that the activities of the station will not be confined to strains suitable for Trinidad only but will be extended and pure strains of native cottons or hybrids suitable for growers throughout the Empire also investigated, with a view of their being tried out finally in different parts of the Empire in order to find out whether they are entirely suited to that particular Country. At the same time the Station is not intended to provide strains of pure line seed for large scale distribution and consequently the scientific side of the research work of various Departments of Agriculture should still be continued.

The informal report on samples of Mora Sleepers by our new Conservator of Forests is one which should be read with interest by everyone engaged in the Timber Industry and particular attention paid to the advice given. Unless this is done not only will wastage continue but as he very rightly points out further orders will probably be considered not justified. That there is a large future for our Timber Industry as soon as the development of our Hinterland is assured few will doubt, and it should be scarcely necessary therefore to emphasize the necessity of placing on the markets abroad none but the best quality sleepers in order to establish our reputation. Further, we would have no hesitation whatever in advocating the inspection and rejection where necessary, of all shipments prior to being sent abroad in order to safe-guard the interests of the Colony as a whole.

Lastly we commend to our readers and especially to our farmers the article on Co-operative Marketing as a factor in Improving Agricultural Conditions. Unity is strength and we can see no reason why movements of this description which are made successful in other countries cannot be made equally successful here. The grading and placing on the market of our agricultural produce after reaping is just as important a factor as the actual growing of the particular crop and should be the means of healthy competition and obtaining better prices. In this connection the help and co-operation of our Village Councils and Local Authorities might be sought for the common good of farmers, who in time could not fail to realise that co-operation among themselves in producing better class produce will be for their own good as well as that of the Colony in general.

Our attention has been drawn to the fact that in abstracts of the Government Mycologists' report on the alleged occurrence of Mosaic Disease amongst sugar canes in the Colony published in our last issue the following paragraph was inadvertently omitted.

"Unfortunately a premature communication of my provisional diagnosis was conveyed, without either my authority or knowledge, to the representatives of the Sugar Industry, and in the process, what had been merely a suspicion became transformed into estabished fact."

MEETING OF THE BOARD OF AGRICULTURE.

A Meeting of the Board of Agriculture was held in the Court of Policy Hall on Wednesday the 30th day of September, 1925. The Hon. Sir John Harrison, C.M.G., M.A., etc., (Director of Science and Agriculture) Chairman, presided; and there were present Messrs. W. Francis, Esq., F.I.C. (Assistant Director of Science and Agriculture) Deputy Chairman; R. Ward, Esq., M.B.E. (Superintendent of Botanic Gardens), the Honourable G. D. Bayley, C.B.E. (Commissioner of Lands and Mines), C. Shankland, Esq., (Director of Co-operative Societies), S. H. Bayley, Esq., Dr. C. L. Whittles (Superintendent, British Guiana Sugar Planters' Experiment Stations), Thomas Earle, Esq., C. R. Williams, Esq., H. A. Britton, Esq., (President of the British Guiana Farmers' Conference), with E. M. Peterkin, Secretary.

Mr. R. A. Altson, Assistant Botanist and Mycologist was also present.

The Chairman tendered excuses on behalf of Captain Edgar Beckett, the Hon. W. M. B. Shields, R. Strang, Esq., E. M. Walcott, Esq., H. L. Humphrys, Esq., and the Hon. J. J. DaSilva.

The minutes of the previous meeting held on June 18th, 1925, having been circulated to the Members of the Board, and having received their approval, were on the motion of the Chairman, seconded by Mr. C. Shankland, taken as read and confirmed.

The Chairman stated that he had received instructions from Government that neither the Governor nor the Officer Administering Government would preside at ordinary meetings of the Board in future, although they may do so at special ones.

The Chairman reported the death of Sir Frederic M. Hodgson, K.C.M.G., V.D., Honorary member of the Board. Sir Frederic was the first Governor to be President of the Board, when he became so in 1906; he took a very great interest in the agricultural development of the Colony, he was responsible for the Board being put on a legal footing, it was through him that we had obtained Agricultural Instructors and Stations in the Pomeroon and North West Districts, and the rubber station at the mouth of the Bonasika Creek. He was also instrumental in getting the Hills and Agatash Estates started.

He moved that the Board pass a vote of condolence to Lady Hodgson and in it record their appreciation of the services that Sir Frederic had rendered in the interest of Agricultural affairs in the Colony.

This motion was seconded by Mr. S. H. Bayley and carried unanimously.

The Chairman also reported the following:—

Return of Mr. E. M. Walcott from two months' leave of absence.

Affiliation of British Guiana Farmers' Conference.

Affiliation of Canal No. 2 Polder Farming Association.

Affiliation of Mahaicony Farmers' Association.

Affiliation of Berbice Agricultural and Industrial Association.

Arrival of a black face Shropshire Ram in place of one which had died.

This had cost the Board nothing as the previous one had been covered by Insurance.

The following were laid:—

Journal, Board of Agriculture, Vol. XVIII. No. 3.

Report of a Conjoint meeting of the Agricultural Exhibition and the Subsidiary Products Committees of the Board of Agriculture, was submitted as follows:—

The detailed minute of Mr. Aaron Britton in which Messrs. Stephens and Thomson (co-optative members) concurred, received the careful consideration of the Committee.

The Committee was unanimously of opinion that taken as a whole the proposals of the Representative of the Farmers, Conference and of the Co-optative members were beyond the present financial resources of Government. The Committee, however, have adopted several of the suggestions in this report.

The Committee decided to recommend to the Board of Agriculture the following as a programme for Agricultural Shows, Exhibitions and Farmers' Competitions to be gradually brought into operation in future years.

Biennial or triennial District Shows to be gradually established at the following places:—

1. Skeldon
2. Port Mourant
3. Rose Hall
4. Blairmont
5. Lichfield
6. Mahaicony
7. Mahaica
8. Belfield
9. Buxton
10. Beterverwagting
11. Craig Village
12. Bagotville
13. Stanleytown
14. Den Amstel
15. Parika
16. Leguan
17. Wakenaam
18. Aurora
19. Anna Regina
20. Charity
21. Bartica
22. Wismar

Alternate years mainly for forest-products but including locally grown provision crops.

The above list of places is subject to alteration according to the Agricultural development of the Districts.

The maximum number to be 11 District Shows and 10 Farmers' Competitions in alternate years. Grants for District Shows should be $200 each and for Farmers' Competitions $120 each, a maximum expenditure of about $3,400 a year when the scheme is in full operation.

Very grave doubts were expressed as to whether the shows held systematically for many years at Buxton and Victoria—Belfield have been appreciably followed by increased development of Agriculture in these Districts either as regards areas under cultivation or improvements in tillage.

County Exhibitions to be triennial, and held in each of the Counties of Essequebo (Suddie) and of Berbice (New Amsterdam) and at Morawhanna for the North Western District. Grants of $750 should be made for agricultural products and of $250 for pastoral products i.e., cattle, at each County Exhibition, but one of $750 only for the North Western District. There should be a County Exhibition at New Amsterdam, Berbice, in 1926 for which $1,000 will be required in aid of prize awards, and $200 in aid of expenses, one in the North Western District for 1927 and one at Suddie in 1928.

Colonial Exhibitions should take place in Georgetown every third or fifth year, County Exhibitions not to take place in such years. Colonial Exhibitions will require at least 3,500 as Grants-in-Aid, and possibly considerably more, say $5,000 if a Live Stock Show also takes place. Such an Exhibition cannot possibly be held before 1927.

The maximum costs except in years when Colonial Exhibitions take place will be $4,400 a year. It will also cost $600 for the Department of Agriculture to be suitably represented at each exhibition or Show, a total expenditure of $5,000 a year.

Mr. Britton strongly objected to Mahaicony being included in the list. This was put to the vote and lost.

SHOWS TO BE HELD IN 1926.

After carefully going into the matter it was decided that the small District Shows on the East Coast taken as a whole have been failures, the only District showing any tangible signs of benefit being the West Bank, which Show has always been representative of a large area and after discussion the following programme was adopted for 1926:—

East Coast.

District Shows to be held at Beterverwagting and at Mahaicony.

West Bank and West Coast.

A District Show to be held at Bagotville.

Farmers' Competitions.

2 To be held on the East Coast in the Victoria—Belfield and the Buxton Districts.

County Shows.

A County Show to be held in New Amsterdam, Berbice.

GRANTS-IN-AID.

Grants-in aid of these Shows to be as under:—

District Agricultural Shows.

$200 each i.e., $150 in aid of the prize list and $50 towards the expenses of the Show.

Farmers' Competitions.

$120 each.

Berbice County Show.

$1,000. $750 in aid of prizes for Agricultural Products, $250 for Live Stock exhibits and $200 in aid of expenses.

The Chairman was instructed to insert in the Draft Estimates for 1926 for the consideration of Government $2,200, an increase of $650 on the vote for 1925 being regarded as normal in view of the desired development of the cultivation of Agricultural Products on the coastlands of the Colony.

Mr. H. A. Britton proposed that the above be adopted. This was seconded by Mr. Thomas Earle and unanimously carried.

AGRICULTURAL STATIONS FOR THE TRIAL CULTIVATIONS OF BANANAS, CITRUS FRUITS AND OTHER ECONOMIC PRODUCTS SUITABLE FOR EXPORTATION.

It was unanimously decided that small scattered stations would not serve any useful purpose in this direction. Mr. Walcott proposed, seconded by Mr. Shankland, that three large scale trial farms of 100 acres each should be established in selected places on the coastlands.

It was estimated that those would cost, without the necessary buildings, $34,000 during the first year with a recurrent annual upkeep of $24,000.

Each farm must be under the charge of an experienced, but relatively young, Agriculturist. The salary of such a man will probably have to be £500 per annum.

Each farm must be carried on for at least ten (10) years.

The cost of three farms was estimated at:—

Installation and first Year's maintenance—

Rental of lands ..	$ 1,800
Buildings, erection of ..	15,000
Salaries, Managers' ..	7,200
„ Overseers' ..	3,400
Cultivation, fencing, drainage, etc. ..	22,500
Miscellaneous ..	1,100
	$ 51,000

or say, in round figures, $17,000 each farm or station.

For later years the annual costs of maintenance would be

Rental of Lands ..	$ 1,800
Repairs, etc., to buildings	1,500
Salaries, Managers' ..	7,200
Overseers' ..	3,400

Cultivation, maintenance, drainage, and new products, etc. ..	15,000
Miscellaneous	1,100
	$ 30,000

or in round figures $10,000 for each farm or station.

The Committee's view was that one station should be established each year during three years, commencing in 1926—the costs would then be:—

First year	(1926)	$ 17,000
Second year	(1927)	$ 27,000
Third year	(1928)	$ 37,000
Subsequent years	(1929 et seq)	$ 30,000

The views of the future Director of Agricultute must be sought for guidance in this extensive programme.

Mr. H. A. Britton proposed that this be adopted. This was seconded by Mr. C. Shankland and unanimously carried.

Mr. H. A. Britton proposed, seconded by Mr. C. Shankland that this report be forwarded to Government as early as possible for their consideration; this was carried.

The Chairman stated that they had received a letter from someone abroad who stated that he wanted to turn the waste mangoes of the Colony into cattle food. When it was made into cattle food they would not be able to obtain more than £4 a ton for it because the nutritious part was taken out. The flesh of 50 average mangoes only contains nutriment equal to one man's requirements for 24 hours. He proposed that the communication be circulated among the members.

This was agreed to.

With regard to the following resolution:

"Whereas the time has arrived for the establishment of new agricultural industries.

"Be it resolved: that Conference decides to take the necessary steps for the establishment of a pine apple industry and a banana industry in addition to the establishment of a cotton industry which are already engaging the attention of the executive committee," the Chairman said that some time ago he found that at Akyma, Demerara River, on some of the ~~B~~Lright lands there pineapples of as fine flavour as he had ever tasted were grown.

Mr. Britton said he thought this motion was covered in the report they had just adopted.

The Chairman said that the establishment of a banana industry was receiving consideration. A few years ago a pine-apple growing industry was started on a large scale at the Hills Estate, the pines being imported from Texas. The pines grew magnificently but when they ripened it was found that the insides of all the fruits were rotten. Mr. Junor grew pine-apples on a relatively large scale at Vreed en Styn for many years, but one of the pine-apple diseases broke out and the industry was abandoned. If Mr. Junor had approached the department they might have been able to find out which diseases it was, which variety of pine-apple was being affected and which were immune to it.

The next motion considered from the Conference was the following:—

"Be it resolved: That this Conference takes the necessary steps to bring about the appointment of a committee to advise the Government.

"(a) Whether or not the remodelling of the Department of Science and Agriculture will not be in the best interest of the Colony.

"(b) Whether or not the Board of Agriculture should be remodelled?

"(c) If the answer to either "a" or "b" or both be in the affirmative, that the committee recommend the manner in which the remodelling should be done in either case or in both cases, as the committee may have previously found."

The Chairman said that Mr. Britton might explain how he wanted the Board and the Department remodelled.

Mr. Britton said that at the conference it was urged that too much devolved on the head of the Department as at present constituted and he was engaged in matters that ultimately were not in the interest of agriculture. He thought that the head of the department should be relieved of certain duties so that he would be able to devote more of his time to agricultural matters. He had not been able to go about the country districts and see farmers where he would be of practical assistance to them. If the Board was remodelled he should be free to go about and see conditions and get into contact with the people for whom he was labouring and whose lot he desired to improve.

The Chairman intimated that they were travelling officers whose duty it was to do that work. It meant the employment of practical agricultural instructors.

Mr. Britton moved the adoption of the motion which was put to the vote and lost.

With regard to the following motion from the Conference:—

"Whereas the improvement in the drainage of Canals Nos. 1 and 2 Polder has led and is leading to the re-cultivation of the lands which makes it necessary for a whole time agricultural instructor to be appointed for the aforesaid Nos. 1 and 2 Canals Polder.

"Be it resolved: That this Conference respectfully requests the Government to take the necessary steps to secure the services of a whole-time agricultural instructor for Canals Nos. 1 and 2 Polder.

The Chairman stated that this would fit in with the proposals embodied in the report above.

The next motion from the Conference was the following:—

"Whereas this Colony is one of these contributing towards the expenses of the Imperial College of Tropical Agriculture; and

"Whereas through no fault of the Director of Science and Agriculture there is no approved scheme by which Government nominated or other candidates from this Colony may gain admission to the said College of Tropical Agriculture; and

"Whereas the Government has referred the question of agricultural education to the Education Commission whose report is not yet issued; and

"Whereas Mr. D. D. Haynes a part-time officer of the Department of Science and Agriculture successfully took the entrance Examination of the said college and subsequently almost entirely through the instrumentality of the Director of Science and Agriculture Mr. Haynes obtained leave of absence and was admitted a student of the said college for a 9 months' course, and

"Whereas it is the considered opinion of this Conference that in order that that student should obtain the fullest advantage and subsequently be of benefit to the Colony.

"Be it resolved: That the Director of Science and Agriculture be requested to recommend to Government that Mr. Haynes be sent back at the re-opening after the vacation to continue and undergo a three-year course on lines similar and with the facilities granted him in the first instance provided that he returns at the 3 months' vacation and puts in service."

The Chairman said that Mr. Haynes had been renominated.

With regard to the following motion from the Conference:—

"Be it resolved: That this association represents to the committee of Conference the necessity of steps being taken for establishing with the approval and consent of Government direct communication between Conference and the Trade Commissioner in London in the interests of all minor industries," the Chairman said that the Board of Agriculture had not the privilege of direct communication with the Commissioner and suggested that the Conference puts itself into communication with the Government on the matter.

The last resolution from Conference was as follows:—

"That Conference make representation to the Georgetown Town Council for the free sale of the small Farmers' crops on landing for not more than 12 hours."

Mr. Shankland reported that the Council had decided that as it was not practicable to land rice at the Colonial steamer stelling after 4 p.m. it could be landed at the Stabroek market stelling and if removed within 24 hours no fee would be charged.

Agricultural Loan Banks. Mr. Shankland stated in connection with these that immediately after his appointment as convener of a committee to deal with the question he got into touch with places abroad where these banks were being conducted. In the meantime the Hon. R. E. Brassington tabled a motion in the Combined Court which was adopted by the Court and accepted in principle by the Government. He had reason to believe that the matter had been referred to the Secretary of State and when the Government had received a reply it was their intention to appoint a committee to go into the details.

Regulations governing services of Stallion Donkeys, their care, and diet, proposed by Mr. G. D. Bayley and seconded by Mr. T. Earle were approved of and adopted.

The Chairman then adjourned the meeting to a date in January to be fixed later.

RESUME OF MINUTES OF MEETINGS OF THE BRITISH GUIANA SUGAR PLANTERS' EXPERIMENT STATIONS COMMITTEE DURING JULY, AUGUST AND SEPTEMBER, 1925.

The Committee met on Monday, 13th July 1925, when the following were present:—Sir John Harrison, Chairman, Messrs. W. M. B. Shields, R. P. Daggett, W. S. Jones, A. E. Craig and D. Clark with the Superintendent and the acting Secretary.

The monthly statement of receipts and expenditure having been passed, the committee commented on the satisfactory financial position disclosed. The Chairman drew attention to that part of the Superintendent's report which pointed out that the re-planting of the 1922 and 1923 seedlings had been completed with the loss of 29 varieties of the former and 146 of the latter, which would have the effect of considerably delaying the work of the station. A discussion took place with regard to the planting of canes in this Colony, the Chairman expressing the opinion that an unnecessarily large number of tops per row were planted but it was pointed out that the effective planting was dependant on the quality of the tops and that close planting tended to reduce the expenses of weeding. Mr. Daggett stated that he got good results by planting 36 tops per row whilst Mr. Shields said that satisfactory results were obtained in Berbice by planting the tops 9 inches apart equivalent to 48 per row, the tops being planted at an angle of about 30°. It was decided to place a sum of $500 for consideration on the draft estimates for 1926 for carrying out a mechanical soils survey of the estates. The Superintendent in reply to an enquiry from Mr. Shields stated that the method in use in Berbice of killifering the soils would not interfere with the comparative results of the mechanical analyses. The Chairman pointed out that up to the present the mechanical analyses of soils had been singularly barren of economic results, but it was possible that useful indications might be obtained by systematic examinations of the fields on several to many sugar plantations. The Field Manager's report and estimates having been discussed and approved, the Chairman mentioned that Antidesma venosum had been found on some of the fields at Sophia, and asked the members of the Committee to keep a look out for this most dangerous pest on their estates. Mr. Craig said that he had found some at Ogle.

* * * * *

At a meeting held on the 24th. August, all the members were present with the Superintendent and the acting Secretary. The monthly statement of receipts and expenditure for July was passed, and the Superintendent's report for July together with the Field Manager's report and estimates for August approved.

With reference to the methods of general cultivation at Plantation Sophia, the Superintendent was instructed by the Committee that the regular methods of cultivation at present in force on the Sugar Estates of this Colony must be followed and that it is essential that the energies of the Superintendent and Chemist should be mainly, if not entirely, occupied by the object for which Sophia was established by the Sugar Planters of the Colony—the raising of new varieties of canes more suitable to local conditions than is the D625. The draft estimates for the ensuing year were next considered.

The Committee decided that in view of the existing serious financial position of the Sugar cane industry of the Colony, the assessment for 1925-26 is not to exceed 25 cents per acre. The Secretary was instructed to advertise for a temporary field manager during the absence of Mr. Bastiaans, the salary to be offered being $100 per month.

* * * * *

A meeting of the Committee was held on Monday the 14th. September at which all the members, with the exception of Mr. W. S. Jones, were present with the Superintendent and the acting Secretary.

The revised draft estimates for 1925—26 were adopted, the estimates being carried out at $26,500.00 and it was decided to recommend to the Planters' Association that the rate of assessment for 1926 should be twenty-five cents per acre.

The monthly statement of receipts and expenditure for August was passed. The Superintendent's report for August was adopted. After considering the applications for the post of temporary Field Manager, it was decided to offer the post to Mr. John E. Kidman on probation.

Mr. Strang mentioned that seedlings Nos. 695, 698 and 711 which had been given a full trial at Plantation Uitvlugt after being recommended by the late Superintendent, Mr. Crabtree, had not turned out as satisfactorily as the D625 the excellent showing of these varieties at Sophia being due to the practically "garden cultivation" which the Field Manager had given them. The Superintendent was requested to make notes in future of the growth of seedlings raised at Sophia on all estates which he visited.

THE EVAPORATION OF SOIL WATER.

The following extracts from the "Report on Sugar Cane Experiments in British Guiana" published in the West Indian Bulletin Vol. XIII for 1913 are of interest in connection with Mr. Maurice Bird's article on "Soil Hygiene in its relation to Disease of Cane."

The important points in connection with the evaporation of soil water, in air and in carbonic acid gas, are as follows:—

Where the evaporation takes place in air nearly free from carbonic acid gas, practically the whole of the calcium salts are deposited as calcium carbonate whilst the water is being concentrated to about one-third of its original bulk, and the remaining water becoming a highly saline one containing large proportions of magnesium salts—the chloride, sulphate and carbonate—in solution. The calcium salts, which are well known to exercise a profound influence in reducing the highly toxic action of the magnesium chloride and carbonate on plants, are almost completely removed from solution and the soil water becomes in a condition poisonous to vegetation. This is what probably takes place during periods of prolonged dry weather on more or less worn-out sugar-cane soils in which by injudicious cultivtaion and especially by long-continued destruction of the trash by burning the normal proportions of organic matter have been largely reduced. Where, on the other hand, the evaporation takes place in an atmosphere heavily charged with carbonic acid gas as in the air present in soils containing the proportions of organic matters normal to good soils the lime-salts remain in solution until the liquid commences to become a saturated brine and thus for a prolonged period continue to modify the toxic action of the magnesium salts. It is possible on such land that the soil water during droughts may become concentrated in the upper layer of the soil without very material injury to the plants until by concentration of the soil-water the toxic action of the sodium chloride exerts itself.

These trials therefore, accentuate the importance of the conservation and, where feasible, the increase of the organic matters present in tropical soils, a point which is far too often overlooked by intensive cultivators of tropical products. The investigation further accentuated the importance of the addition of more or less soluble salts of lime—the nitrate, sulphate or "superphosphate"—to soils containing excesses of soluble or actively poisonous salts of magnesium.

Résumé—The marked alkalinity and the high content of salts of magnesium and of sodium chloride of the ascending subsoil water act detrimentally on growing crops during dry seasons, and may be the cause of much of the cessation of active growth, of the wilting and of the scorching of crops soon after the commencement of and during the dry season.

Where the soil contains much organic matter undergoing active oxidation, the soil-water during its concentration remains saturated with carbonic acid gas, and its evaporation takes place in an atmosphere of that gas. Under these conditions, the salts of lime present in the soil-waters are retained in solution until the water approaches its point of saturation, and they beneficially modify the toxic action of the magnesium salts and the sodium chloride on the plants. Where the soil is deficient in organic matter the lime-salts of the soil waters are thrown out of solution at a comparatively early stage of concentration, and on such soils the toxic action of the magnesium salts become very marked during dry seasons.

SOIL HYGIENE IN ITS RELATION TO “ DISEASE ” OF CANE.

By Maurice Bird B.Sc.

Part I.

In the August, 1922, issue of “ The International Sugar Journal,” *the writer detailed instances of plant diseases being directly traceable to the lack of plant food to make a vigorous, healthy growth, and I would like now to record a striking example of what at first appeared to be an epidemic, but which was apparently a withering and dying of cane due to what Harrison years ago very aptly called the unhygienic condition of the soil.

At the close of last year after a fine growing season throughout the autumn, the cane in places on several Estates with which I am connected began to wither at the top, growth appeared to cease and death ultimately ensued. As the trouble was too wide-spread to be accounted for by local conditions the matter was referred to the Government Mycologist, who after a thorough examination concluded that the cane was not diseased and suggested that the cause of death might be a toxic condition of the soil.

In the meanwhile the writer had been making the following analysis, which I will first tabulate and then discuss.

ANALYSIS OF SOILS FROM AFFECTED FIELDS.

	Volatile Matter % Soil.	Ingredients soluble in a 1% Solution of Citric Acid.				
		Lime	Magnesia	Potash	Soda	Phos. Acid.
1.	13·04	·094	·004	·020	·095	·004
2.	11.92	·062	·003	·010	·107	·005
3.	12·78	·108	·021	·013	·146	·004

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* Page 406.

Analysis of Soil sifted from and adhering to the Roots of dead Cane.

Volatile Matter % Soil.	Ingredients Soluble in a 1% Solution of Citric Acid.				
	Lime	Magnesia	Potash	Soda	Phos. Acid
16·68	·070	·082	·024	·021	·022

Analysis of the Ash of the Juice from "dead" and "live" Cane respectively.

	"Dead"	* "Live"
Silica % Ash	10.83	7.69
Lime % Ash	2.74	2.13
Magnesia % Ash	7.63	4.88
Potash % Ash	22.18	20.29
Soda % Ash	1.14	1.26
Phosphoric Acid % Ash	2.81	1.92
Sulphuric Acid ($S.O^3$) % Ash	13.39	14.05

While, in the above analysis of soil from withered cane fields, the phosphoric acid is on the low side, we frequently find it lower still without any appearance of dying cane; also, the analysis of sifted soil from the roots of dead cane shows such a large amount of plant food as to preclude any possibility of starvation being the cause of death. When, however, we examine the relationship of lime to magnesia the condition is not so satisfactory

The widespread belief among sugar soil experts, that an excess of magnesia over lime exerts a toxic effect on cane, suggests that this may account for the withering and death in the case under discussion, for this excess is evident in the soil surrounding the roots of the dead cane, and to a much greater extent in the ash of the cane itself.

* Much of this cane also ultimately withered and died.

The soil of the affected fields is of an extremely impervious nature, being a very stiff clay, and apparently, due to the abnormally rapid growth of the cane, the increased demand for lime for the greatly extended foliage, drew more heavily upon the soil for this element closely adjacent to the roots, than could be supplied without causing a toxic ratio of lime to magnesia to result. Had the soil been loose and porous, permitting a free circulation of soil water and hence of lime, probably no trouble would have resulted, since the average composition of the affected fields shows a satisfactory ratio of lime to magnesia.

On the death of the cane, the demand for lime ceasing, the slow circulation of the soil water probably more or less completely restored the equilibrium between the lime and magnesia, for the succeeding crop "sprung" nicely and has now for several months been growing vigorously and healthily.

If the above is the right explanation of what at one time gave considerable anxiety to the authorities of the estates affected, and there seems to be nothing to contradict it, then the obvious safeguards against a recurrence, are such agencies as will render the soil more porous, such as the incorporation of vegetable matter, more thorough tillage of the soil and applications of lime for the double purpose of flocculating the soil and acting as a reserve in times of abnormally vigorous growth.

I may add that three such "epidemics" are on record in this Colony, each following a propitious season of rapid cane growth.

The original source of magnesia is found when these soils are submitted to hydrochloric acid, the solvent dissolving almost invariably far more magnesia than lime, ; with a 1% solution of Citric acid, however, more lime than magnesia is, as a rule, dissolved from the soil, and as the solvent action of the acids of the roots are supposed to resemble such a citric acid solution, this fact may in no small measure account for the usual healthy growth of cane in the Colony.

PART 2.

As the withering of cane, of which I wrote under the above heading on June 15th, of the present year, continued in isolated cases, the following investigation was planned for two Estates and carried out on each Estate absolutely independently of the other.

Samples of Withered Cane were taken from fields showing it, and samples were taken from fields showing no trace of it, on each Estate. These samples were divided into roots, stalks and leaves, and the resulting twelve samples were cut up as finely as practicable, and after drying, burnt to ash. The lime and magnesia were then determined in each sample, and the lime-magnesia ratio calculated. Simultaneously the soils from which the cane was taken, were analysed; each Estate doing its own work in its own laboratory with the following results:—

LIME AND MAGNESIA IN ASH OF "WITHERED" AND "GOOD" CANE AT "P.M." AND "R. H." ESTATES.

	Estate	Roots	Stalks	Leaves	Date Harvested
Withered Cane.					
Lime % Ash	P.M.	1.60	3.62	3.13	11.7.25
	R.H.	.48	1.22	2.05	28.3.25
Magnesia % Ash	P.M.	2.12	7.70	2,66	11.7.25
	R.H.	1.26	5,44	2.12	28.3.25
Ratio Lime to Magnesia	P.M.	1:1.3	1:2.1	1:.84	
	R.H.	1:2.6	1:4.4	1:1.0	
Good Cane.					
Lime % Ash	P.M.	1.10	3.13	2.01	13.7.25
	R.H.	.52	1.88	2,52	2.5.25
Magnesia % Ash	P.M.	.97	7.54	2,63	13.7.25
	R.H.	.81	6.55	2,61	2.5.25
Ratio Lime to Magnesia	P.M.	1:.88	1:2.4	1:1.2	
	R.H.	1:1.5	1:3.4	1:1.0	

Analysis of the Soil Upon Which the Above Cane Was Grown.

	Estate—Field.	Description.	Volatilo matter per Soil.	INGREDIENTS SOLUBLE IN A 1% SOLUTION OF CITRIC ACID PER CENT. SOIL.					
				Lime	Magnesia	Ratio Lime to Magnesia	Potash	Soda	Phos. Acid
WITHERED CANE.									
P.M.	Tain Windward. 26	Gray Clay.	13.64	.077	.029	1 ; .37	.017	.113	.003
R.H.	B.D. 15	Gray Clay.	16.47	.043	.032	1 : .74	.029	.024	.003
GOOD CANE.									
P.M.	Auk. O.G. 15.	Dark Grey Clay.	14,52	.082	.014	1 ; .17	.018	.055	.005
R.H.	Canefield 33	Dark Grey Clay.	17,02	.035	.019	1; .54	.019	.005	.005

Beside analyses compiled and quoted by Deere Geerligs and Spencer, the lime in the above analyses of ash is strikingly low throughout, not only compared to the magnesia present, but in its actual percentage of the ash.

Also the predominance of vegetable matter in the fields producing no withered cane, is very obvious from the colour, and still more so when the soils are shaken up with water, comparatively large quantities rising to the surface, while in the case of the grey clay producing the withered cane, little or no vegetable matter is to be seen, when this soil is similarly treated.

From this, I conclude, that the organic matter kept the soils of the last two fields loose and porous, permitting a flow of lime in solution to the roots, and so prevented the dire need of it by the plant.

When this agency failed, as in the gray clay, to keep the soil channels sufficiently permeable, the supply of lime did not suffice for the vigorously growing crop and withering and death of the cane ensued.

The withering of cane, then, is not so much a menace of disaster, as a curtailment of the yield, when the growth is especially vigorous, and, then only on stiff clay lands with insufficient vegetable matter to keep open the channels for the flow of an increased supply of lime solution, demanded by this increased growth.

SUGAR-CANE CULTIVATION

The following article by F. S. Earle Esq, Agronomist, is taken from the Journal of the Department of Agriculture, Porto Rico.

Sugar-cane agriculture in the West Indies is fifty years behind the manufacturing side of the industry. It is hard to understand why this should be so, but no one conversant with the facts will dispute it. Nothing is more urgently needed than to bring the work in our canefields into accord with the farm practices long recognized as indispensable in the growing of other similar crops. Sugar cane, in order to produce a maximum yield, requires a heavier rainfall or a more abundant supply of irrigation water than is needed for most crops, and it needs it, too, for a longer period. Now the only known way to supplant rainfall and to conserve soil moisture is by giving frequent surface tillage to form and preserve a dust mulch. This has been thoroughly understood for many years and it is the regular practice with all similar crops. Why not with sugar cane, which needs it even more? In the corn belt no one thinks of planting corn without giving it constant cultivation. Even as drouth-resistant a plant as cotton is cultivated most carefully. In Louisiana cane is cultivated like a corn field. It is only here in the West Indies, on the hardest and most compact soils and with the most capricious of rainfalls, that we expect cane to grow and yield full crops year after year without this fundamentally necessary assistance. Our present methods have come down to us fron the times when cane was planted on new lands—freshly cut over timber lands. No special cultivation was needed then, nor is it needed today on such new lands. The humus which they contain so abundantly holds moisture and the decaying rootlets leave the ground porous and well aerated. All this changes with age as the soils become hard and compact, when this porousness and permeability to air, so necessary for plant growth, has to be restored by tillage. The roots of sugar cane are very susceptible to lack of air. When the soil becomes encrusted they quickly suffer and are apt to be attacked by the fungi causing "root disease," a condition causing more losses to cane on old lands than all of the other cane troubles combined. It is "root disease" that has caused so many of the old standard varieties to fail as the land becomes more hard and compact through continued cropping and the loss of vegetable matter. In one country after another first Otaheite and the Rayada and Cristalina have gone down and been abandoned on account of "root diseases." This trouble has caused the loss of untold thousands of dollars in all parts of the sugar-cane growing world, and yet it is easily controlled. Three things are required, and of these each is as important as the other: first, proper drainage; second, abundant fertilizing, and third, frequent tillage. Used with good judgment and common sense these three things will prevent nineteen-twentieths; yes, ninety-nine hundredths of the cases of root disease, and at the same time will so increase yields that they will prove a decided economy and not an expense.

More tillage, then, is a necessity if we are to secure full yields of cane on old lands, first, to conserve moisture and, second, to aerate the soil so that the roots may be supplied with oxygen, for they are living things and, like everything else which has life, they take in oxygen and give off carbonic-acid gas. When the soil is hard and encrusted this necessary exchange of gases is impeded and the vitality of the plant suffers. Anything which lowers the vitality of the cane plant permits the attacks of the root killing fungi. Again, the presence of oxygen in the soil is necessary for the growth of those soil bacteria that are instrumental in transforming the crude plant food contained in the soil into nitrates and other forms in which it is available for growth. In badly aerated soils another set of organisms develop which destroy these nitrates and thus rob the soil of its fertility. Some recent investigators have gone so far as to claim that this effect of tillage in rendering the plant food in the soil more available is the real reason for its beneficial effect during period of drouth. The soil solution is made richer in plant food and so less of it is required to keep the plant in active growth. Be this as it may, the outstanding fact remains that frequent shallow tillage during dry weather aids remarkably in keeping crops in active, vigorous growth. Why, then, do not cane planters, like other farmers, take advantage of this long-known and well established fact? The only answer is that they are still blindly following the customs of their fathers: customs sufficiently well adapted to the fresh new lands of those times, but not adapted to the compacted and partially exhausted lands of today.

By tillage is meant any stirring of the surface soil between growing plants with implements. This may, of course, be done by hand with the hoe or rake. The surface scraping usually done with the hoe in Porto Rico can hardly be called tillage since it does not break the surface crust. Usually it is more cheaply and effectively done by implements drawn by animal power. Mules and horses are better adapted to this work than oxen and usually their work is much cheaper. Tillage by tractors is surely coming in the near future, but so far it has hardly passed the experimental stage. The kind of implement to use for cultivation will depend on the system of planting adopted and to some extent on the nature and condition of the soil. The more generally useful tools are the 5-shovel cultivator, the 13-tooth harrow cultivator, the double shovel, the single shovel or Georgia stock with its various attachments and the small 7-inch turning plow. First one and then another of these implements should be used according to the condition of the land and the amount of weed growth. The small reversible disc harrow with only six discs is often very useful, especially when the land was crudely prepared. The straddle-row riding cultivators had best not be attempted until after our labor becomes accustomed to handling these simple instruments. When properly handled these implements, working as they do on both sides of the row at once, are great savers of time.

There are three principal systems of cane planting in use in Porto Rico. Each will require special methods of cultivation in order to secure best results. The irrigated lands are mostly planted on the Hawaiian system, first successfully introduced by the late Patrick MacLain when he was Administrator of Central Aguirre. In this method the cane is planted at the bottom of deep furrows which are laid out as nearly as possible on the level grade lines. These planting furrows are crossed at intervals of thirty to forty feet by light furrows for bringing in the water. This secures a more uniform distribution of water than is possible with the old system of running the rows with the grade and allowing the water to follow them for considerable distances. Having to maintain the banks between the rows to confine the water makes tillage more difficult than where level culture is possible. This has been made an excuse for doing little or no cultivation on the irrigated lands of the southern coast where the tendency has been to depend on irrigation water alone to make the crop. This is a serious mistake, especially in the ratoon fields. Much better results will follow if each irrigation is followed within a few days by a cultivation to break the crust and restore a dust mulch. From 20 per cent to 25 per cent less water will be required and better crops will be secured. For this cultivation it is best to alternate, using first the harrow-cultivator held at an incline first on one side of the bank and then the other. This implement tends to pull down the banks and after using it a few times the 5-tooth cultivator should be substituted for it, putting on the broad hilling-up wings that come with it and taking off the three forward shovels. The wings should be set to turn the dust toward the middle and the width should be adjusted to fit the bank. This will restore the central ridge to hold in the irrigation water. The single shovel or Georgia stock with a 16-inch "heel sweep" may now be used between this central ridge or bank and the cane to clean out and open up the water furrow. By the alternate use of these three cheap and simple implements irrigated cane may be cultivated easily and effectively. Simply follow every irrigation or rain by a cultivation. That is an easy rule to remember.

Dry uplands that are unirrigated and where no extensive drainage is required are best planted on what may be called the Cuban system, since it is employed so widely in that island. The cane is planted in deep furrows as for irrigation but, it is usual to run through with enough slope to carry off an excess of rainfall. These furrows are gradually filled in by the cultivation and when the cane is laid by the ground should be nearly level. This is the simplest kind of cane cultivation. The seed should be placed in a single continuous line in the bottom of the furrow—not in a double line nor in wide "holes" with spaces between, for this leaves space that requires hoe work. Any of the above-mentioned implements may be used with this system of planting. If done frequently enough to destroy the grass and weeds as they are sprouting, the 13-tooth harrow-cultivator will be the only implement needed, and, if care is taken each time to run close to the cane, almost no hoe work will be required. If continued rains do not permit cultivation and the cane gets grassy it will be necessary to use either the double shovel or the small turning plow, but these implements should be followed closely by the harrow-cultivator. It will pay to run the cultivators as often as every ten days, or in some cases even oftener. Always cultivate as soon as possible after a heavy rain. Remember you are not cultivating primarily to kill weeds but to aerate the soil. Weed killing is a useful secondary benefit.

All wet lands that require drainage should be planted on the Porto Rican *gran banco* system. Many Porto Rican cane lands are of this nature and this system has been developed here locally to meet these conditions to which it is admirably adapted. In Louisiana cane is also planted on low, wet lands. There they meet this condition by planting on top of sharp single-row ridges. The land is prepared much as for planting according to the Cuban system, but the cane is planted on top of the bank and not in the furrow, which is kept open for drainage. This Louisiana system would not be well adapted to Porto Rico, since here cane even on wet lands sometimes suffers from drouth and these narrow ridges would dry out unduly. The Porto Rican *gran banco*, wide enough for two cane rows, do not dry out so quickly. When laborously made by hand with the shovel, which is still the usual practice, they are very expensive. In most cases there is no need at all for this and it is a custom which should be immediately abandoned. No conceivable "protection duty" will serve to make cane growing permanently profitable if such expensive practices are followed. Most of these wet lands are dry enough at some season of the year to admit of preparation with the plow. They should be prepared at such times. Deep plowing is not required but the surface should be well pulverized by several harrowings. Then lay off the banks with a big turning plow giving two cuts in the same furrow, and removing as deep as possible. Clean the furrow either with the big double mould board (*bombo*) or with the Martin grader or with both, and the banks are made. Open a light furrow on either side of the bank with a 7-inch turning plow as a guide in planting and plant in a single line (*chorro.*) Do not destroy the bank by making a deep furrow for planting and do not plant in holes for this makes your rows so wide that there is no space for cultivation. Cultivate on top of the bank with the harrow cultivator much as in the Cuban system. Before the ditches get set with grass clean these with a pass of a medium-sized double-mould-board plow. The one used in Cuba for opening planting furrows and there called a *limpiador* will be but right. This will keep the ditches clean much cheaper than it can be done by hand. On very wet lands where there is constant standing water in the ditches the above directions cannot always be carried out. In such cases it is usually better to make wide 20-foot banks with deep permanent ditches between them. These will likely have to be made by hand and they should be carefully run in the direction to give best drainage. After the ditches are opened the land will be soon dry enough so that the top of the bank can be prepared with a small 8- or 10-inch plow. There will be room for four rows and level cultivation can be given. This plan is working well in actual practice.

Whatever plan of planting is followed it is of great importance to put at least 400 pounds of fertilizer per acre in the planting furrow before planting. A second application can be given at the side of the cane row when it will be covered by the cultivation after the cane is two or three feet high. Subsequent applications, however, cannot take the place of this first one in the bottom of the planting furrow. This not only places it where it will be immediately available for the young roots as they form, thus insuring a vigorous early growth, but, by its deep application it induces a deep rooting habit that better enables the young plants to resist drouth. Applications made after planting are necessarily placed above the roots and the tendency is to induce a shallow root growth. The importance of this matter cannot be too strongly insisted upon, though it seems to be little understood in Porto Rico.

It is, however, in the ratoons that better cultivation is most urgently needed. With plant cane the ground has been thoroughly loosened and mellowed in the preparation for planting so that in many cases fairly satisfactory growth is secured with a minimum of cultivation. In the ratoons the soil has been compacted by the trampling of men and teams in getting off the crop and it is of urgent importance to restore it as soon as possible to a condition of mellowness and good tilth. The practice should be much the same with either of the systems of planting. First line the trash in alternate middles and let it lie there as a mulch throughout the season. This reduces the area to be cultivated by one half. The expense of transferring the trash and working the second middle may usually be avoided since the heavy mulch tends to soften and mellow the soil beneath it. Each row will therefore be mulched on one side and cultivated on the other, thus getting the benefit of both. In the case of *gran banco* plantings, however, it will be necessary to at first line the trash in the ditches and later transfer it to the top of the bank after that has been thoroughly pulverized. As soon as possible after lining the trash and before much new root growth has started, "bar off" each side of the cleaned middle with a 10-inch ploy running as close to the cane as possible and throwing the dirt toward the middle. In the furrow thus formed put in the first application of fertilizer. On most soils it will be best to mix this in the soil by passing a subsoil flow to stir and open up the soil still more deeply. This should be immediately followed by the harrow-cultivator to pulverize the furrow sluices that have been thrown out and to partially fill the furrows and cover the fertilizer. After this the work will be about the same as in plant cane. An implement of one kind or the other should be passed every ten days or two weeks until the cane closes. The main point is to see that it is passed quickly enough after each heavy rain to prevent baking and the forming of a heavy crust that will impede aeration.

The expense of the method of cultivation here outlined will be but little if any greater than at present since it will save the larger part of the hoe work. It will largely increase yields and will make possible the taking of many more ratoon crops than at present. Above all, nine-tenths of the present losses from root rot will be avoided. Try it out carefully, gentlemen, and see the results for yourselves.

Obituary.

SIR FREDERIC HODGSON, K.C.M.G., V.D.

It is with extreme regret that we have to record the death of Sir Frederic Mitchell Hodgson, K.C.M.G., V.D., an Honorary Member of the Board of Agriculture which took place at his residence, 21, Rosary Gardens, London, on August 6th, 1925.

Sir Frederic Hodgson, who was born in 1851, was the son of the late Rev. O. A. Hodgson, Rector of East Stoke. He entered the Secretary's Office of the General Post Office in 1868 and remained there until his transfer to this Colony in 1882 as Postmaster General. From 1888 to 1900 he was successively Colonial Secretary and Governor of the Gold Coast, and it was during the latter period of his administration of that Colony that the quest for the famous Golden Stool of the Ashantis took place which led to the Siege of Kumassi, when he and Lady Hodgson narrowly escaped loosing their lives. From 1900 to 1904, he was Governor of Barbados, and will always be remembered in that Colony for insisting on the grant-in-aid voted by the Imperial Government for the relief of the planters in 1903 being used as a capital for the Sugar Industry Bank instead of being distributed among the planters. The wisdom of that policy has on more than one occasion since been of immense benefit to that Colony.

It was in 1904 that Sir Frederic came to this Colony and administered the Government until 1911, when he retired.

During his administration here he always took a keen interest in matters agricultural, and it was during his regime that the Board of Agriculture was put on its present legal footing. We owe to his sympathetic interest also our Agricultural Stations at Pomeroon and North West Districts, the rubber station at the mouth of the Bonisika Creek and the Lime Estates at Hills and Agatash.

Sir Frederic was married in 1883 to Mary Alice, daughter of the late Mr. W. A. G. Young, C.M.G., Governor of the Gold Coast, who with one daughter, Mrs. Cecil Martin-Sperry, survives him. To them we extend our deepest and sincere sympathy.

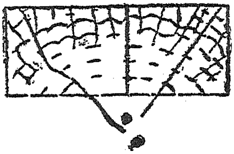
INFORMAL REPORT ON SOME MORA SLEEPERS IN THE SHOWROOM OF THE TRADE COMMISSIONER FOR BRITISH GUIANA.

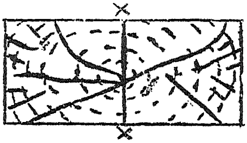
By B. R. Wood,

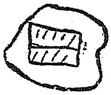
Conservator of Forests, Forestry Department, British Guiana.

I understand that an order has been obtained by someone in the colony to supply a number of Mora sleepers to Railways in South Africa, also that a considerable percentage of the sleepers shipped have been rejected on arrival in South Africa. I have furthermore seen one of these sleepers in the City, said to have been sent as a sample. Whilst I do not know the grounds on which so large a number of sleepers have been rejected, an examination of the sleepers in the Trade Commissioner's showroom and the alleged sample in the City, makes me think it probable that the principal reason is that the sleepers were wrongly sawn, and chiefly from the smaller parts of the boles of the trees.

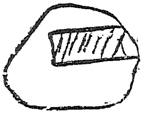
I do not know the specification, but generally speaking no Railway Engineer will accept a sleeper in the butt of which he can see the centre of the tree. The reason is that the medullary rays which radiate from the centre of the tree towards the edge are definite lines of weakness. A sleeper sawn from green timber shrinks as the timber dries. This sets up strains in the wood. A sleeper sawn from the side of the tree has these rays running at an angle across its butt, and the shrinkage causes a large number of fine surface cracks to appear which are of no consequence, as in the diagram where the radial lines are the rays. The thicker ones going right across being the ones emanating from the centre of the tree which is shown by the dot below. If however the sleeper is sawn with the centre of the tree in it, the rays are as shown in the diagram and it will be seen that the ray marked x.x. makes a definite line of clevage right across the sleeper. When the sleeper dries out and shrinkage occurs the sleeper splits down this line and is then quite useless. Of the sleepers in the trade Commissioner's office I should personally, have rejected a large percentage for this fault. All contractors should be warned that no sleeper will be accepted unless two sleepers were sawn from the section of log from which it came, i.e. like this. It can readily be imagined that a parcel of sleepers sawn wrongly in this way, hastily put green in a ship's hold, would, to the uninitiated look very nice on loading but after 3 weeks in a hot hold would, on emerging look like nothing so much as a casualty clearing station.



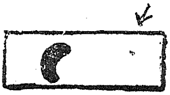




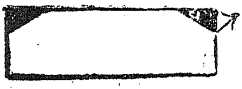
When green sawn sleepers dry there is always a small percentage of splits in any case. What should be done is that after sawing all sleepers should be stacked, preferably in the shade for two or three months, and then the splits weeded out before loading in a ship. This is far cheaper than having 30% of the stock left derelict on a foreign quay for the fuel dealers to take at a knock down price after the Railway people have concluded that a repeat order is not justified.

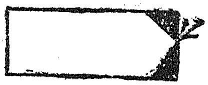


Sleepers should be free from wane, i.e. the edge of the tree must not show. The rounded corner is a give away, it proves sawing very close to the edge of the tree, which means that the edge of the sleeper will soon rot out. I saw one sleeper showing that. A ring shaken sleeper should be rejected at once no one can tell when it may fall in half. Any such sleepers in the line is an always present risk of a derailment.



Preferably there should be no sapwood. Particularly under the rail seating. A little is less objectionable if the rails are chained. If there is any it must *never* be on more than two corners and that across the breadth of the sleeper. This is not very objectionable. The Sap can be laid uppermost and when the corners rot off the rail seating is still sufficient. If the sleeper is chained it is scarcely affected. On two corners in the depth of the sleeper it must be rejected when the corners rot off such a sleeper may rock in the line. The sleeper in the City looked to have this defect, it also had a very large knot. The sleeper should as far as possible be free of knots, especially near the rail seating, as knots are sources of weakness, and will not hold dog spikes. Sleepers must be sawn true to plane and of the correct scantling. Undersize in depth is the worst defect,





COTTON RESEARCH STATION.

Trinidad Selected As Its Site.

The Empire Cotton Growing Corporation recently appointed a Sub-Committee consisting of Prof. J. B. Farmer, M.A., D.SC., F.R.S., and Mr. L. G. Kilby, B.A., B.SC., to report upon Trinidad as a possible site for a Central Cotton Research Station. Before selecting Trinidad as a possible site consideration was given to other areas, particularly Africa, which is the scene of the Corporation's main activities. The Sudan was rejected on account of its trying climate and the special conditions under which the plant is there grown in the irrigation areas, and the Transvaal and Natal partly owing to the comparatively long and expensive journey from England. Outside Africa, Ceylon and Cyprus were among the other places whose claims were fully discussed, but, though possessing certain advantages, these were outweighed by their drawbacks. After exhaustively examining the possibilities of several different parts of the Empire, the Sub-Committee suggested that Trinidad might be found to possess more advantages and fewer disadvantages than any other place.

It was recognised that the presence of the Imperial College with Dr. Leake, whose research work in Cotton in India and Africa is well known, as Principal, and Dr. Harland, with considerable research work in Cotton in the West Indies to his credit, as Professor of Botany and Genetics, would be of great advantage to the Research Station, if it were so situated that they could interest themselves in its work. Moreover, the Experimental work on Cotton carried out at the neighbouring Government Experiment Station and the College, and reports on rainfall were most encouraging. It was recognised that the fact that Cotton has been grown as a commercial crop in the island on a small scale, and had since been abandoned, might clearly have an important bearing on the proposed station. Sir Francis Watts in a valuable memorandum on the subject (printed as Appendix 1 to the Report) attributed the failure to three causes; (1) some of the sites selected have probably the worst soil for cotton in the island; (2) they were situated in regions with a very high rainfall; (3) the Cotton was planted so that it matured during the wettest time of the year. The only success achieved was that of Mr. McInroy on the St. Augustine Estate in the neighbourhood of the College where there are several miles of country unquestionably suitable for Cotton in respect of both soil and climate, and it is in this neighbourhood that the Corporation proposes to establish the Station.

The fact that cacao, coconut and sugar-cane have proved and are likely to continue to prove, more attractive to estate owners, is extremely fortunate, since no difficulties are likely to arise from the risk of hybridizing commercial crops of Cotton from several varieties grown for experimental purposes, and it at once renders the task of controlling pests easier by the absence of any extensive area from which they can draw their food supplies. Doubts as to climate were set at rest by a comparison of rainfall and temperature records at St. Augustine with similar records for the principal cotton-growing States of America, the chief cotton-growing islands of the West Indies, and also for countries in tropical Africa where the crop is grown.

Fortunately there is an area of about 60 acres within 500 yards of the College which the Corporation will be able to purchase from the Government and private owners. This would enable a small isolated sub-station to be established as an insurance against the total loss of material by pests or diseases. Crop rotation can be practised and any small profit realised from the sale of commercial crops, such as sugar-cane, offset against the expenses of research. Such an area would allow for expansion of the work and always permit at least 20 acres to be devoted to cotton cultivation.

Prof. Harland presented a comprehensive scheme of work for the Station. From this the Committee selected cotton genetics and physiology as the subjects most urgently demanding research, and as those which would form a nucleus from which other work would grow. Genetics is considered as of first importance. It is rightly emphasized that it would be a waste of money and resources to select for such a post any but a really first-rate man, possessing not only recognised scientific ability but also a capacity for organising and handling junior staff and workers.

Next in importance to genetics is the need for a plant physiologist. The relations of the plant to soil, to climatal and general physical environment, and the connections between water, whether as rainfall or soil water and the yield, together with the quality of the crop, are still imperfectly understood, and urgently call for investigation. Such work cannot but prove to be of high importance in the commercial productions of cotton. Such physiological investigations whether from a laboratory or a field point of view, must be somewhat expensive on account of the instruments and apparatus required for such work, but is clear that the necessary expenditure should be incurred. Researches of this kind are almost necssarily prolonged, and quick results should not be expected.

It will readily be recognised that the results obtained at the Central Station will not necessarily, or even probably, be found to hold without modification in other regions where the soil and climate may be very different, but nevertheless the basic principles discovered will be of very wide application. The station should be Central not merely in name but should also serve as a means of suggesting appropriate investigations to be conducted in other cotton growing lands, where the different factors of climate, soil, &c., which may influence the actual behaviour of the cotton plant in such countries, may be carried out, perhaps under advice from the Central Station. Even qualities of cotton which may be regarded as "genetically fixed" may be found to be affected by climatal variations. This opens up the whole question of acclimatization. The Report visualized the possibility of members of the staff in the Central Station being detailed for service to solve special problems elsewhere and, with the accumulating knowledge which such officers would be able to bring to bear upon the subjects, such mutual contact should be of the greatest importance to the cotton-growing industry as a whole. The Central Station should in fact become the clearing house for all cultural problems and the overwhelming advantage of possessing a specialized and skilled Staff, accustomed to deal with this class of investigation, available for such service, needs no further emphasis. The scientific work already done in connection with the cotton plant and its lint emphasizes how much more still remains to be elucidated in the fundamental conditions which govern the growth of the plant and influence the properties of its fibre.

The two principal members of the Staff will, then, be a Geneticist and a Physiologist. Instead of a whole-time Director of the Station it is proposed that a local Committee of Management consisting of Dr. H. Martin Leake and Mr. W. Nowell should be appointed to guide and co-ordinate the work of the Station and to report to the Corporation. It should be emphasized that these two gentlemen would act in a purely private capacity and not as representatives of the organizations to which they are attached, as it is essential that the Station should be entirely autonomous and in no way under the direction either of the College or the Local Department of Agriculture. It is suggested that the Staff should consist of a Physiologist and a Geneticist, each with a senior, a junior and a non-graduate assistant. In addition a computing clerk, a filing clerk and typist, and five laboratory assistants together with a number of semi-skilled labourers would be necessary as a nucleus subject to subsequent expansion as the Station develops.

As a consequence of the establishment of the Central Station it is proposed that the experimental work now carried on in St. Vincent by the Corporation should eventually, though not immediately, be discontinued. Arrangements are suggested by means of which the Central Station could be kept in close touch with the Universities and similar Institutions at home and the Experiment Stations in Cotton-growing lands within the Empire.

Both the College and the Colony have reason to congratulate themselves upon the choice of Trinidad as a site for the Research Station. The Corporation has recognised the advantage of the proximity of the Station to the College while the College, on the other hand, will derive considerable benefit from the situation of the Station, particularly in connection with the post-graduate students sent out by the Corporation to the College for training, for they will be brought into intimate contact with the work of the officers of the Station with whom the closest connection will afterwards have to be maintained.

Tropical Agriculture Vol. II. No. 8.

THE WORK OF THE IMPERIAL BUREAU OF MYCOLOGY.

E. J. Butler, C. I. E. D. Sc., MB.,
Director.

The serious study of the depredations caused to cultivated crops by parasitic fungi and bacteria dates from comparatively recent times, and it was not until after the beginning of the present century that any organised attempt was made to ascertain the cause and seek methods of prevention of crop diseases in the tropical and sub-tropical parts of the Empire. As agricultural departments were established in the various dependencies, officers were appointed who were charged with the duty of investigating the diseases of plants and devising means for their prevention or control. These officers are usually termed "mycologists," though the names "plant pathologist" or "phytopathologist," used in other countries, more aptly describe their functions. There are not far short of 100 such experts at present at work in the overseas parts of the Empire, all with very few exceptions, attached to Government Departments of Agriculture.

In some cases these workers enjoy facilities not inferior to those available in the best equipped laboratories and research stations in England. In others, and this applies particularly to the tropical areas, certain facilities are poor. The chief lacks in such cases are a good library and access to authentic specimens of the parasites known to cause disease in plants. There is nothing more discouraging than to find that work which has cost much time and labour has already been done somewhere else, or that a supposed new parasite has previously been studied and its ways are known. Even in the best equipped centres it is difficult to keep pace with the mass of research and practical work that is going on in many parts of the world, and to see and find time to read all the publications (many in obscure journals or difficult languages) that have a bearing on one's work.

In the past, assistance in such matters was provided by the Royal Botanic Gardens, Kew, and the British Museum of Natural History at South Kensington. Germany had carried the systematic study of the subject beyond the point reached by any other country, and German assistance was almost indispensable to the overseas worker. With the outbreak of war the inadequacy of these arrangements became painfully evident, and both in England and in the dependencies means were sought to satisfy the requirements of the scattered band of mycologists throughout the Empire. The Imperial Bureau of Mycology was the result.

The Bureau was founded in consequence of a resolution of the Imperial War Conference passed on July 8, 1918. The subject was brought to the notice of that body by the Colonial Office, which, impressed by the success which had attended the efforts of the Imperial Bureau of Entomology, founded five years earlier to meet a similar situation in regard to insect pests, thought that the time had come to establish a like organization to deal with the other great class of destructive agencies in agriculture—namely, the diseases of plants caused by fungi. A number of the overseas Governments expressed their readiness to contribute to the support of the Bureau, and work was eventually started in September, 1920. The affairs of the Bureau are managed by an honorary committee appointed by the Secretary of State for the Colonies, with Earl Buxton, G.C.M.G., as Chairman. Its finances are on a temporary footing, and negotiations are in progress to extend them for a period of five years from April 1, 1925.

The work of the Bureau falls naturally into two main divisions: it serves as a clearing-house for information on all aspects of plant pathology other than those concerned with insects and the like, and it examines and reports on specimens sent in from all parts of the Empire.

As a centre for information the Bureau endeavours to keep in touch with the work on the diseases of plants going on throughout the world. A staff of linguists is engaged in reading all the literature on the subject published in any part of the world to which access can be had, and in making abstracts of all original papers. These abstracts are printed monthly in a journal published by the Bureau, the *Review of Applied Mycology*. They are given in sufficient detail to enable workers in many cases to dispense with reference to the original paper, and are issued sufficiently promptly to keep up a survey of current activities in the whole field of plant pathology. The monthly numbers at present contain from 100 to 120 abstracts, and the volume for 1924 runs to 752 pages, exclusive of the index. The latter is in great detail, as the value of an abstracting journal in after years depends on the readiness with which references to particular matters may be looked up. No attempt is made to secure a satisfactory balance sheet in regard to the *Review*: to do so would be impossible without charging a prohibitive price per copy, as the circulation is practically limited to the comparatively few who are directly interested in the subject. Hence, an appreciable proportion of the Government grants is applied to the production of the *Review*, and copies are supplied free of charge to all the contributing Governments for the needs of their departments. At the recent Imperial Mycological Conference, held in London last July, a resolution was passed expressing appreciation of the service rendered by the *Review* to all workers on the subject, especially those in the overseas parts of the Empire. It is probable that no branch of the work of the Bureau has been more widely approved than the publication of this journal, and its reception has been scarcely less cordial in America and on the Continent than within the Empire.

Another aspect of the information service is the furnishing to enquirers of references regarding previous work on a problem. In order to deal with such enquiries the Bureau aims at keeping up a comprehensive card index to the literature on plant diseases, and in addition, maintains a large lending library of original papers in pamphlet form available for issue on demand. This library numbers over 6,000 items, cross-indexed by subject and author, and is increasingly being made use of by overseas mycologists. Extracts and translations from publications not easily available are also asked for at times, and requests for information of one kind or another are received in considerable numbers, almost by every mail. Recently a demand has arisen for copies of sections of the subject card index to be made available for some of the larger departments and these are being issued at cost price.

The examination of, and reporting on, specimens sent from overseas is the second main activity of the Bureau. Progress in this branch of mycology is less advanced than in regard to insects. The fungus flora of a great part of the British tropical and subtropical dependencies is not well known; an enormous amount of work remains to be done before an adequate account could be given of, say, the fungi of Tropical Africa. Plant disease surveys have been undertaken in some areas, but these are, as a rule confined to recording the diseases which cause notable damage to important crops. Unfortunately, a parasite that may be inconspicuous and relatively harmless in one area may cause a major disease in another. Many years ago the writer collected an insignificant leaf-spotting fungus on cotton in Kashmir which proved to be new to science. Nothing more was heard of this until, in 1920, a severe outbreak of a new disease of cotton was reported from Arkansas, and on investigation was found to be due to the same fungus. How it got from Kashmir to Arkansas (or *vice versa*), and what countries in between it affects, are not known, but it is evident that every record of its distribution would be of importance.

Within the limits of the capacity of its small staff the Bureau tries to aid in gaining a more detailed knowledge of the fungi of the colonies. In some, such as Ceylon, little or no outside help is required, for such knowledge is already far advanced. In others, intensive collection is much needed, and it will be many years before the survey is completed. The number of systematic specialists available for the study of these collections in England is small, and progress is likely to be slow even with the aid of foreign workers.

In addition to this general systematic work a large amount of time is devoted to the examination of individual specimens, often of obscure diseases or of parasites whose indentification is difficult. In regard to this part of the work the position of the Bureau is somewhat like that of a consulting physician, except that it does not aim at dealing with all such enquiries itself, but passes many of them on to other specialists. In every case the idea is to get the best advice available, whether in England or abroad. The organization of the information side of the work is called into service here, since it is through the latter that the Bureau keeps in touch with active workers in various parts of the world and is usually in a position to know at any given moment who are working on any disease or group of fungi that the specimen may belong to.

A couple of cases illustrating this branch of the work can be taken from enquiries regarding cotton diseases that have been dealt with during the past year or two. The outbreak of black arm disease, caused by *Bacterium malvacearum*, in the Sudan, is one of the serious problems which the Sudan Plantations Syndicate has to face. The Bureau has been in close touch throughout with Mr. R. E. Massey, the Sudan Government Botanist, in whose hands the investigation of this problem is placed. The first isolations of the parasite were sent to the Bureau to confirm its identity with *B. malvacearum*, and new cultures made from these were transmitted to Dr. Erwin Smith at Washington, the original describer of the parasite. He tested it fully, and reported that it was a variety of this organism, which was known also in the United States, but had not been described in detail. It is probable that without such an authoritative opinion there would still be doubt whether the disease was really black arm. Furthermore, the search for a satisfactory method of disinfecting the seed has been aided by the Bureau putting Mr. Massey in touch with institutions and firms most likely to be of assistance to him. The recent promising trials of izal against the same disease in the West Indies were arranged entirely through the Bureau. The prevalence of black arm in Nigeria has just been reported to the Bureau, which is thus in a position to put the local mycologist in direct touch with practically all that is known about it elsewhere.

A second interesting case is concerned with an obscure fungus which has been known to attack cotton and other plants in India for a number of years. More recently Mr. Briton-James, the late Mycologist to the Ministry of Agriculture in Egypt, found a similar fungus injuring cotton in that country. Dr. Shaw of Pusa, India, suggested that the Bureau should compare the parasite with a fungus *Sclerotium bataticola*, which attacks sweet potatos in the United States. Cultures of the Indian, Egyptian, and American fungi were grown side by side at the Bureau and proved to be identical. The curious thing is that the fungus has not been reported on cotton in America, while in the other countries it has not been found on sweet potatos. Quite recently all three strains have been tested on sweet potatos in Uganda, and all were found to rot the tubers just as described in America In Uganda the same fungus infects beans, and will doubtless be found on cotton too, while from Nigeria it has recently been received on cotton and ground nuts.

It can easily be realized that a single enquiry of the nature of those mentioned above may occupy several months and involve, in such cases as the last a good deal of laboratory research. Apart from this kind of work. however, the Bureau does no original research, since it has always maintained the view that research into the cause and control of plant diseases must be done on the spot.

While the Bureau, for obvious reasons, works as a rule through the local departments of agriculture, its services are freely available to non-official mycologists. These are fortunately few as yet, but the example set by the Indian Tea Association, the Rubber Growers' Association, and a few large corporations such as the Colonial Sugar Refining Company in Australia, in maintaining their own research staffs (including mycologists), is worthy of wider imitation. The existence of the central organization outlined above will undoubtedly make such a policy easier to adopt, and will smooth the path of the individual workers in small, isolated scientific centres, such as one may hope will be founded in increasing numbers by the plantation industries in the overseas parts of the Empire.—*The Empire Cotton Growing Review, Vol. II. No. 1.*

HOME CURING OF BACON.

E. PRATT SADDINGTON.

TYPE AND TREATMENT OF PIG.—In the production of prime bacon one must begin well, and it is essential to have in mind the importance of choice of pig, housing and feeding. Careful attention in this way means very much towards success, whilst neglect brings probable or certain failure. The animal should be of the type calculated to give satisfactory results by way of growth and quality of flesh in the right position, with good proportion of lean, there being few people who really enjoy fat bacon, and when fat is excessive it is often a source of great waste.

Many consider the pig to be a dirty animal and treat it accordingly, but actually it thrives and gives best results from every point of view, when kept under clean conditions. The piggery should be dry, roomy, light and well ventilated, but the animal must not be exposed to strong sun or to draughts.

Moderate exercise is beneficial, preventing cramp and other ailments. Daily cleansing and an occasional lime-washing of the sty will minimise the unpleasant odour generally associated with such buildings, and which often acts as a deterrent to the keeping of pigs.

Food should be as fresh as possible, clean, of suitable proportions and given at regular intervals, in quantities readily cleared up. It is distinctly wrong to allow accumulations of stale food in the piggery or elsewhere.

Highly fermented strong-smelling foods are likely to have a bad effect upon the appetite and health of the animal and consequently upon the bacon. Fishmeal must be of best quality and used with discretion or the flesh is apt to be tainted. Vegetable oils in too large proportion produce soft, oily fat with a tendency to turn yellow.

For commercial purposes the carcass should not weigh more than 200 ℔., but for home use a rather larger carcass may, under some circumstances, be found convenient, although it is not economical to keep a pig longer than seven to eight months, since quite 3½ ℔. of meal is required daily for maintenance alone.

SLAUGHTERING AND DRESSING.—The best time for slaughter is from November to February, when flies are less active and weather of more suitable temperature. The slaughter-house should be clean, and situated at no great distance from the piggery in order to avoid undue excitement when transferring the animal. It is fairly common knowledge that, if the pig is in a high state of perspiration at the time of slaughter, curing may be difficult.

Accumulations of dust and rubbish where flies may congregate should be removed. The carcass may readily become tainted from drains or foul odours of any description. If possible a current of clean air should pass through the slaughter-house. A competent man should be chosen to carry out the actual slaughter, dressing and cutting up.

When it is decided to convert the carcass into bacon, the pig must be fasted for twenty-four hours, but its discomfort may be lessened by allowing it plenty of clean water.

When being taken from the sty the animal must not be beaten, bruised or roughly handled in any way, and twisting or jerking of the legs should be carefully avoided. Bruised flesh does not cure, and hams frequently go wrong because the joints have been injured. Even a small bruise will cause accumulation of blood, which develops an unpleasant odour, and surrounding parts quickly become tainted.

A plentiful supply of both cold and boiling water is necessary when scalding, and clean, dry straw if it is intended to singe. The use of too hot water blisters and discolours the skin, as does the flame when unskillfully applied, so that care is essential if one would have bacon of good appearance. After dressing the carcass should be allowed to hang until cold, but not longer than 24 hours after scalding, or curing may be indifferent.

Methods of cutting up vary. Many take out much of the lean for the making of pies, sausages and other tasty dishes, but this is unwise as it leaves too large a proportion of fat for bacon. All trimmings can be utilised, so that no rough, irregular pieces should be left on the bacon. The carcass is easier to handle if the hams are cut out and dealt with separately, but there is more cut surface, which means additional waste and shrinkage.

CURING.—The place where curing is effected must be clean, cool and free from flies. It is well to turn out the apartment thoroughly and lime-wash, where possible. There must be no perceptible odour from drains, nor must strong-smelling foods, such as fish or onions, be permitted in the vicinity of the bacon. A salting trough or tub is the most practical thing, but when this is not available a clean board, shelf, table or brick thrall such as is found in most cellars and dairies would serve the purpose for dry-salting. For hams only earthen vessels are used. Metal utensils are unsuitable.

Ingredients should be of the best quality. Salt should be pure, fine and dry, and that prepared for table use is not recommended for this purpose. Saltpetre should also be pure, fine and dry. It is used to preserve the red colour of the lean, and is, therefore, especially useful in the ham and shoulder. When applied in large quantities it hardens the meat, but correctly used is decidedly helpful. Sugar prevents hardening and shrinking of the fibres, and gives flavour.

Bay salt is considered less harsh than the ordinary kind and is sometimes used in equal quantities with, but never wholly taking the place of common salt. Salt should be prepared by drying and crushing it into fine powder. Saltpetre is better purchased from a reliable chemist, who will grind it, and, as far as is possible will guarantee its purity.

The best Demerara sugar is preferable to the common brown variety. The recipes for curing are numerous and varied, but the following are simple and give good results. No great skill is necessary, but cleanliness, accuracy in weighing out ingredients, thorough rubbing of all parts until the surface feels slightly moist, and general attention to detail are essential to success.

(1) For every 20 ℔. of meat allow 1½ ℔. to 2 ℔. salt, 1 oz. saltpetre, ½ lb. Demerara sugar. Rub the meat with salt only and leave the cut or meat surface uppermost until next day. Drain away blood and moisture. Rub thoroughly, especially the ham and shoulder, with saltpetre, then with sugar and salt mixed, repeating the rubbing daily with sugar and salt until all is used, which will be in three to four days. Turn the bacon each day during the rubbing period.

Leave for three to four weeks, turning once weekly, and pouring the liquid over the bacon frequently if salting in a vessel where it accumulates. If a board or shelf is used this cannot of course be done.

Hams require four weeks and if they are cured in the side the whole must be left for that length of time. When curing is complete the next thing is to prepare for drying. With clean, cold water, rinse away all surplus salt, wipe with clean, dry cloths, scatter pepper freely around bones and in places where flies are likely to attack, and hang to dry in a warm room, but not too warm or the bacon will rust. To keep off dust whilst drying it is well to cover with muslin or even loosely with paper.

In about three weeks it should be dried sufficiently. It should be regularly dry and firm all over, but not hard and as unbendable as a board.. The odour should be mild and pleasant. Place in calico or hessian bags and store in a cool, dry, well-ventilated room. It is better to suspend separately and not to place one side upon another in boxes or otherwise. Examine occasionally. If soft damp patches appear it is not keeping as it should, but this is not a common occurrence unless through neglect. If there is reason to doubt the keeping quality of ham or bacon plunge a knitting pin or thin sharp knife to the bone, draw it out, and the odour which clings to it will indicate whether the bacon is good or otherwise.

Some object to the flavour of sugar and prefer salt and saltpetre only. The latter make very good bacon, which cures and keeps well, but is inclined to be harder than when sugar is employed.

(2) For every 20 lb. of meat allow 2 lb. salt and 1 oz. saltpetre. Rub thoroughly, both skin and cut surface, with saltpetre. then with salt. Place one side upon the other with a good sprinkling of salt beneath, between and on the top, and leave for three to four weeks, turning the bacon weekly. The hams usually require four weeks and if cured in the sides the whole must be given that time, otherwise the bacon may be removed and the hams left a week longer. Drain away dissolved salt. When curing is complete, wash, to free it from surplus salt, wipe with clean absorbent cloth, and hang to dry as before directed.

Head and Feet.—The head and feet should be cured in the same way as the sides and may be placed in the same receptacle, but careful watch must be kept as the offal occassionally does not cure well, and should this happen, the bacon would be tainted by contact. After curing, the chaps, which are the lower part of of the head, may be dried and kept for months, but the other parts are better cooked within three weeks. They make excellent brawn.

SMOKED BACON.—If smoked bacon is desired and no properly constructed room is available, there are places where this can be done for a small charge. A room may be improvised, but a suitable building must be chosen. The walls and floors must be fireproof. After the bacon is cured instead of hanging to dry in the ordinary way the sides are suspended from the roof of the building. Upon the floor is placed a layer of clean, dry straw, and upon this, to the depth of three inches, a layer of sawdust. The straw is set alight and the sawdust smoulders, giving off the requisite smoke, in which the bacon should hang. This must be kept going continuously for from several days to a month according to the flavour desired. If only a mild smoking is required a few days in the room is sufficient, but the bacon must be thorougly dried before storing, as in the case of plain curing.

The sawdust must be clean and dry and preferably from oak; that from the resinous woods is unsuitable.

The lower-priced, inferior smoked bacon one finds on the market is flavoured by immersing in a "smoke" bath, but this method is not recommended. If properly handled bacon will keep good a year or longer, and it should not be cooked under three months from the time of slaughter, although some really enjoy it when it has just finished drying.

—*Journal of the Ministry of Agriculture Vol. XXXII. No. 5.*

BRITISH GUIANA AT WEMBLEY.

QUEEN MARY VISITS B. G. PAVILION.

The Queen, who was accompanied by Lady May Cambridge, and attended by Lady Elizabeth Hesketh Pritchard and Mr. Harry Verney, paid her sixth visit to Wembley on July 3rd, and in the course of the morning spent upwards of three quarters of an hour in the West Indian and British Guiana Pavilions.

She was received at the West Entrance of the British Guiana Pavilion by Sir Graeme Thomson, Governor of the Colony and was graciously pleased to accept a bouquet from Lady Thomson. The Commissioner, Mr. J. B. Cassels was presented to Her Majesty, who then made a close inspection of the exhibits. She was much interested in all that she saw and especially the Jungle and the Timber and Bauxite exhibits, and before leaving signed her name in the Visitors' Book.

OFFICIAL VISIT BY SECRETARY OF STATE FOR THE COLONIES.

The Secretary of State for the Colonies paid an official visit to the West Indian and B.G. Pavilions at Wembley on the afternoon of July 28th. He was accompanied by Mrs. Amery and Lt. Col. and Mrs. de Satgé, and was met by the Hon. Commissioner, Mr. Algernon E. Aspinall who conducted him round the various sections where the Commissioners and Representatives besides a number of visitors from the West Indies were presented to him. The party was shown around the B.G. section by Mr. J. B. Cassels, Colonel May and Mr. F. E. Everington, and they were very interested in the exhibits. Replying to a few words of welcome from the Honorary Commissioner, Mr. Amery said how pleased he was to be able to visit the Pavilion, and expressed the hope that he would soon have the opportunity of visiting the West Indies.

The West India Committee Circular.

CACAO.

SOME BOTANICAL PROBLEMS.

S. C. Harland, D. Sc. (London), F.L.S.

(The following article forms the substance of a recent address by Prof. Harland to the Trinidad and Tobago Agricultural Society.)

One of the most striking features of a cacao plantation is the enormous variation in yield from tree to tree. Of two trees both apparently similar in healthiness and vegetative vigour one will yield a hundred or more pods and the other few or none. A similar situation is characteristic of other tropical tree crops, for example, it has been noted in the East in rubber that 75 per cent. of the crop is often being produced by less than 30 per cent. of the trees. This means that a large number of trees are not paying for their keep and may be described as 'boarders.' The situation is most nearly analogous to that existing in a commercial herd of dairy cows. As long as the farmer is content to record the amount of milk he receives only in bulk, he cannot take any steps towards improvement, but when he begins to record the individual milk yields he soon discovers that certain cows are not worth keeping and replaces them by better animals. To analyse a little further, the low milk yield of some cows may be due to inadequate nourishment or to disease, but everyone knows that if a cow is inherently a poor yielder, no amount of care and attention will ever effect any improvement. As we say in Yorkshire, "You can't get a quart out of a pint pot."

It is enormously important for the cacao planter to eliminate the poor yielding trees, and to replace them with heavy bearing types. But before we can do this a certain amount of initial study is necessary on the way in which the yield of a cacao tree is built up. In the first place pods come from flowers, and we have to decide first whether the small yield of pods in some trees is due to a correspondingly small number of flowers.

A little study will show that as a rule the number of flowers has very little, if at all, to do with the size of the crop, and it is often the case that the unproductive and barren trees are producing large flushes of flowers but are not setting any pods.

Since mere number of flowers is not of great importance it is clear that a study of the pollination and the setting of fruit in cacao is an essential preliminary to the wider question of how yield is built up. We have carried out an extensive series of experiments at the College on the question of pollination and our results may be briefly summarised as follows:—

1. Direct observations by the microscope have shown that only about 5 per cent. of flowers ever received any pollen in their stigmas at all and 95 per cent. are therefore doomed to pass through their life history without any chance to set fruit.

2. If flowers are hand-pollinated there is a survival of 5 per cent. of the flowers on the 10th day, at which time small fruits have developed of 2-3 mm. in diameter. After this period there is practically no further loss by mere shedding, though many fruits fail to reach maturity either through disease or lack of nutrition.

3. The setting percentage of 5 per cent. in hand-pollinated flowers should be compared with the figure 0·3 per cent. in non-pollinated flowers.

4. In flowers attended by ants and aphides, about 2 per cent. of setting occurs and we have calculated that efficient pollination takes place in about 35 per cent. of flowers attended by ants and aphides.

5. The results of flower examination, involving the recording of the history of nearly 4,500 flowers by my assistant Mr. G. O. Johnson, having established beyond reasonable doubt that either ants or aphides or both these insects, are responsible for a considerable amount of pollination, and the low percentage of setting on control flowers renders it likely that they constitute the chief pollinating agents at the St. Augustine Experiment Station where our experiments were carried out.

It is conceivable that thrips of the flower-inhabiting type (not the injurious species), also play some role, but they were practically absent in our material.

6. Elimination of crawling insects by bands of an adhesive substance demonstrated the presence of another pollinating agent probably a night-flying insect which efficiently pollinated about 1 per cent. of flowers.

We can now proceed a step further. Though the percentage of pollination is small and the percentage of flowers which set fruit seldon rises above 5 per cent.; it is probable that lack of pollination is never the main cause of a poor crop, for nature provides such an enormous number of flowers that the setting of even one in a thousand would produce a heavy crop. Our experiments in hand pollination led us, however, to an important conclusion. In certain trees—unproductive trees, several hundred flowers were pollinated without a single pod being set, but on other trees—good bearing trees, a large number of pods could be set at any time by hand pollination. We have thus arrived at what is probably the main factor distinguishing productive from unproductive trees; the former are good "setters" and the latter bad "setters." It is clear that from the practical point of view the elimination of poor "setters" is entirely feasible, and the breeding out of a strain of high setting capacity could be done without the slightest difficulty. Certain varieties of cotton for example suffer unduly from the shedding of buds, flowers, and young fruits, and it has been possible to isolate strains comparatively free from shedding.

The breeding of a variety or varieties of cacao of uniformly high productivity offers a few difficulties which merit some discussion. A tree may be regarded as the resultant of the interaction of its hereditary factors plus its environment. There is no such thing as a cacao which breeds true to type, for we have shown by methods which are somewhat too detailed to relate here that cacao is cross-fertilised in Trinidad to the extent of about 30 per cent. There is a kind of tree which occurs sporadically on estates under the name of "Male Cacao," which is characterised by complete sterility of the anthers and should therefore be more properly termed "Female Cacao." Examination of the stigmas of flowers of such a tree will show that pollen is being conveyed from neighbouring trees, probably by an unknown night-flying insect.

The existence of such a large amount of natural crossing means that the cacao trees of Trinidad are a set of extremely complex hybrids, whose progeny show the usual type of Mendelian segregation. The main fact about a hybrid is that it cannot breed true, so that the mere taking of seed from high-bearing trees will not insure a high bearing progeny. Nevertheless, the progeny of some trees will show a higher mean yield than the progeny of other trees, and what must be looked for first is the ability to transmit yield rather than the actual yield of a tree itself. Boiled down, the theory of breeding cacao is this, that the value of a tree for seed purposes can only be estimated by taking the average yield of its daughter trees, and using this as a basis for selection. I need not elaborate the theory any further; its exact working out is somewhat difficult and demands a knowledge of the working principles of genetics. But in closing my remarks on breeding for high productivity in cacao I shall draw your serious attention to the fact that while the entomologist and mycologist have had a fair scope for their work, the specialist in plant breeding has never had a chance and it is time that he had one. If you had a cacao experiment station in which a hundred self-fertilised progeny were grown in rows from each of 500 high bearing parents from all over the island, it would not take more than a few years, say three generations, before trees guaranteed for high productivity would be available for wide distribution.

To turn for a moment to another aspect of yield, it has been thought that by using budded trees from known heavy bearers, fields of uniformly high productivity could be obtained. There are, however, difficulties in the way of such a supposition. In the first place, it has been shown that yield depends considerably on "setting capacity." When you bud a tree does the "setting capacity" follow that of the stock which is an unknown quantity or does it follow that of the scion? There are many reasons for believing that the stock in this connection is at least as important as the scion, and it has been shown in cotton that a shedder can be partially converted into a non-shedder by the employment of a suitable stock. The converse of this is also true. Experiments with grafted and budded rubber in the East have also led to the conclusion that the stock is of very great importance in influencing yield, and the Dutch workers are now of the opinion that the only test of the value of a tree for budding purposes must be based on an examination of its vegetative descendants. If a tree produces good vegetative offspring it is a good tree; if it does not, it is a bad tree. The figures obtained for the yields of budded cacao at River Estate indicate that some of the budded strains are good, while others are decidedly bad. I believe that there is room for both budded and seedling cacao in Trinidad, but the future for the latter is probably greater. It is important to note also that the seeds from budded cacao though uniform in size need not necessarily be uniform in quality, for if a budded Forestero is pollinated by Criollo pollen the resulting seeds will probably partake somewhat of the Criollo quality. That is, Mendelian segregation may take place in a single pod with respect to quality and there may be half-a-dozen qualities present in such a pod. The unit of quality must therefore be taken as the single bean.

Before closing, I should like to emphasize the point that the manufacturing end of the cacao industry is a quarter of a century behind that of the cotton industry in its attitude towards its raw material. The cotton spinner now realises that uniformity of quality is based on pure strains of cotton, and he realises that all his manufacturing processes are based on the behaviour of a single cotton hair as the unit. When the cacao manufacturer realises the importance of linking up his activities with those of the grower, we shall then, and not until then, be able to breed cacao for quality. At present we cannot do this because the manufacturer has not reduced definition of quality to exact scientific terms and until quality is analysed in a precise manner from the chemical, physical, and botanical points of view the plant breeder will continue to be held up.—*Tropical Agriculture, Vol. II., No. 9.*

CO-OPERATIVE MARKETING AS A FACTOR IN IMPROVING AGRICULTURAL CONDITIONS.

JOSE S. CAMUS.

Acting Chief, Agricultural Extension Division.

While every effort is exerted in developing our agriculture by increasing our production, the writer believes that the desired result cannot be obtained unless the farmers learn the methods of handling their products properly for the market through systematic co-operative marketing. A good farmer must not only know the best methods of farming; such as the proper preparation of the land, seed selection, crop rotation, the control and eradication of pests and diseases, but must also know the standardization of his products, as well as its proper packing and shipping before putting them on the market so that they may command a good price.

Our farmers to-day do not receive the full money value of their crops and find farming unprofitable for lack of systematic co-operative marketing. The introduction of this system into our farming activities would improve our agriculture in general, and would save our farmers from the usurers and speculators. Some farmers, especially those living in distant provinces, plant crops that will only supply home demand because they find it unprofitable to plant them in a large scale for lack of a good market, and, if there is any market at all, the price will not cover the cost of production and transportation. The marketing expenses, however, can be minimized if the farmers will only group themselves and sell together their farm produce at regulated prices.

Thus, while it is important that our farming methods should be developed, it is equally necessary that the marketing side be improved in order that the farmers may get the full money value of their crops.

Although the organization for co-operative marketing is comparatively recent in the Philippines, there is no doubt that it can be carried out here successfully as in other countries. It may take time, however, before good results can be obtained but it will not take long before our farmers will see its value.

CO-OPERATIVE ORGANIZATIONS ABROAD.

The first agricultural co-operative organization formed was in Denmark, organized in the year 1860, with the object of improving the live-stock and grain industry in that country. That organization, though of a different type from that of the present agricultural co-operative organizations, served its purpose, for the interest of the farmers was better taken care of and a great deal of work was done in improving farm seeds by producing better strains of plants and making these improved seeds available to the members of the society. Originally, it was composed of small farmers but later on the big wealthy landowners in Denmark joined the organization when they realized the value of co-operation in solving their agricultural problems. Because of this movement much was accomplished in increasing production and in suppressing monopolies which existed in that country.

The work of developing agriculture through co-operative work among the farmers is being done more or less successfully in almost every country in Europe, in India, and in the United States. In the countries mentioned above there are but a few co-operative producers' associations at present that can be considered really successful. It was only in 1895 that the agricultural co-operative organization became an important factor in the United States in improving agriculture. One of the earliest co-operative marketing associations organized in that country was the Cranbery Growers' Association of New Jersey and Massachusetts. This association was not wholly co-operative as the product was sold separately and the returns were made to each member, on the basis of the sale of his individual crop. The products were sold under the brand of the individual grower and not of the association. After a few years this method proved to be wholly unsatisfactory, and so the members decided to form a central agency, known as the National Fruit Company, which handled all the products of the members under the company's name.

At present the most successful work in co-operative marketing in the United States is found on the Pacific Coast among the fruit growers of California, Washington, and Oregon. At the beginning the farmers found out that the method of marketing their crop was a very complex business because of the nature of the fruits, which is perishable. It was then impossible to distribute them to all parts of the United States and to export them to foreign countries. As the fruits produced varied in quality, the association took charge of standardizing the fruits handled and of packing and shipping them. By this process, grade and quality of the produce were assured and the association established a reputation. Later on a number of these local associations of growers grouped themselves into a central organization to handle their business on a more extensive scale. These organizations helped materially and were responsible for the success of the fruit industry in the United States to-day.

In 1914, an agricultural marketing society was organized in Burma to sell rice and peanuts direct to the wholesale dealers in Rangoon. The exporters protested to the Government of India claiming that the organized co-operative society had raised the prices of the products and as a result the merchants and consumers suffered. The committee assigned to investigate could not find any evidence to support the merchants' charges and the Government did not take further action. Due to the organization, unnecessary middlemen were eliminated and a better understanding between the wholesale dealers and the producers in India was established.

PHILIPPINES.

In the Philippines co-operation in various forms is part of the scheme of the work of our farmers, yet no efficient systematic organization of co-operative marketing was ever attempted until 1913 when work in this direction was started by the Bureau of Agriculture. Before this work was begun, the Director of Agriculture sent out letters to all provincial governors to find out what has been done along this line. From the replies received it appeared that no organisation of this kind existed in the Islands except two of a quasi-co-operative character found in Bulacan Province, one operating a rice mill and another operating a rice-threshing machine. The Societies were both composed of farmers who put up these machines for milling their own rice and those of others, charging some money or palay for milling.

Another association found was the Davao Planters' Association organized to foster and stimulate the cultivation of hemp in that province and to defend the interests of its members.

In July, 1914, an office of co-operative organization was created in the Bureau of Agriculture to induce the farmers to group together in order to better their conditions, and to pave the way for the solution of their marketing problems.

Ex-Vice-Governor Martin during his administration started the movement. The initial work done was the organization of municipal and provincial agricultural societies. It was planned to have insular and provincial agricultural councils to look after the staple products such as abaca, tobacco, coconut, sugar and rice, and to organize the farmers according to their products. It was expected that through the organization of these co-operative agricultural societies the products of the members could be marketed co-operatively.

The support of the provincial and municipal authorities, the Constabulary and the schools were secured in fostering this plan, and as a result there were 200 municipal agricultural societies organized by the Bureau of Agriculture in 22 provinces with a total membership of 15,000 in 1914 and a total of 286 municipal agricultural societies in 29 provinces at the close of 1918.

Of these associations but a few succeeded to come up to expectations Among the municipal agricultural societies organized, the one in Pangil, Laguna, which has conducted co-operative marketing successfully is worth mentioning. This society started with small capital and gradually built up a fund amounting to P1,100. The members started the enterprise by buying the coconuts produced by the members and sold them direct to the wholesale dealers in Manila. Other societies which attained a similar success are the municipal agricultural society in Lumbang, Laguna and that in San Antonio, Zambales.

CHAMBERS OF AGRICULTURE.

In 1922 at the convention in Manila during the Carnival by the provincial governors, the presidents of the Agricultural Congress and of the Philippine Chamber of Agriculture, and the Secretary of Agriculture and Natural Resources, it was agreed upon to organize in the provinces, provincial and municipal chambers of agriculture in order to develop among the farmers a simple co-operative system of buying and selling their products and placing them on the market with the least possible intervention of the middlemen and the speculators.

PRODUCERS' ASSOCIATIONS.

This plan was carried out in some provinces, but the results obtained were not promisnig and so in April, 1922, another campaign was started to organize producers' co-operative marketing organizations composed of farmers producing the same kind of crop only such as banana planters, vegetable raisers, poultry raisers, mango growers, tobacco producers, milk producers, etc. This plan was considered better than the previous ones for as the members produce the same kind of crops the association can handle the business better and the members will have one common interest.

At the start many difficulties were encountered in organizing these producers' associations and pessimism prevailed in some quarters because of the sad experiences of the people due to the mismanagement and abuse committed by officers and other members of previous organizations. The middlemen capitalized these failures and opposed the new organization, but in spite of these difficulties, thirty local co-operative producers' associations were organized in 1923 by the Bureau of Agriculture.

Efforts were also made by the Bureau of Agriculture to enable these associations to market their products direct to Manila. To start with, a central milk agency was established in the city which handled the products of four milk producers' associations in the provinces. Later on the Rizal Farm Mercantile Co-operative Association of Caloocan, Rizal, has also established an agency in Manila. Another milk agency was established in San Fernando, Pampanga, by the Pampanga Milk Producers' Association where milk prepared in a sanitary way was handled locally in a commercial scale.

The products of the Banana and Papaya Growers' Associations, however, were sold to the Manila Fruit Company and the National Fruit Company established in the city, as well as to other dealers.

The only Tobacco Co-operative Producers' Association so far organized by the Bureau of Agriculture is the one in Nemmatan, Jones, Isabela. This association will handle tobacco crop of its members. The adoption of better methods of culture and better handling of tobacco are among the helpful activities of the association.

The Bureau of Commerce and Industry is also working along this line, and has so far, according to information, organized a tobacco association in Tuguegarao. With the combined efforts of these two bureaus and the co-operation of the Bureau of internal Revenue, more of these associations can be established in the Cagayan Valley which may be depended upon to solve the present tobacco problems.

Under the present method of marketing there is absolutely no incentive for the planters to produce better crop. The buying and selling of unstandardized products is not conducive to the production of better crop, as no better price is paid by the tobacco buyers for quality.

The tobacco crop passes through many hands before it reaches the manufacturer or exporter. As a consequence, the compensation of the intermediaries is added to the price of the product. Their elimination through co-operative marketing organization will, it is believed, redound to the benefit of the planters and the exporters, as the former will get the full value of their product, and the latter will pay a reduced price for the reason that they will not employ too many buyers as they do at the present time.

CONCLUSION.

There is no reason why co-operative marketing cannot be developed in this country as with the development of co-operative marketing the farmers will undoubtedly get better price and will be able to dispose of their product more easily. They will also learn the standardization of the produce as to kind and quality; the proper distribution thereof to the market; the regulation of its supply and the proper method of selling and advertising all of which are still not known to our farmers.

In the work of co-operative marketing three things can be demonstrated. First, agricultural co-operative marketing association creates a community spirit in any line they want to undertake; second, it serves as an important factor and as a medium in promoting agricultural interest in any province or municipality by increased production and by the standardization of products for the market; third, the success and failure of each association primarily depend upon the kind of management coupled with facilities.

Much has been said and written on the advantages of organising co-operative associations with encouraging, instructive and convincing suggestions. People read and realize all these advatages, but when they are put into practice it is surprising to meet so many obstacles and difficulties in persuading farmers to engage on this profitable way of doing business.

A noted economist has said: "Of all the classes of society the farmers are the most easily divided, the most reluctant to stand together for their common defence and the promotion of their common interest."

So far as I have observed, the following are some of the obstacles which cause failures in co-operative marketing work in this country:

1. The ignorance of proper method of marketing the product as a limiting factor in the dissemination of the value of co-operative marketing organization.

2. The lack of business ability of the officers and frequent and systematic supervision and auditing of the accounts of the association.

3. The lack of economy as a cause of failures of co-operative organisations, especially those just starting. Oftentimes the officers forget to exercise all economy possible that what little income the association may gain is also lost. It is very essential for any young association that its expenses do not exceed the income.

4. The general weakness of the co-operative spirit and loyalty of the members to support the society.

Every member exercises his individuality, feels independent and in cases where societies exist, the members do not look upon themselves in any other light than to throw his advantage and competition with each other in securing personal interest to the society.

5. *Opposition.*—The question of opposition is closely allied to that of loyalty; for while loyalty is maintained opposition is ineffective.—The Philippine Agricultural Review. Vol. XVII. No. 4.

Meteorological Data—July—September 1925.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evapo-ration.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity, Mean
Botanic Gardens.												
July ...	8·67	5	13	1	3	...	22	4·62	86·2	75·7	80·9	79·9
Aug. ...	6·54	9	6	1	2	...	18	4·78	86·2	75·3	80·7	81·1
Sept. ...	3·04	3	...	...	...	1	4	6·54	87·2	75·8	81·5	77·8
Totals	18·25	17	19	2	5	1	44	15·94				
Means.	...	...	...	...	...	...	...	...	86·5	75·6	81·0	79·6
Berbice Gardens.												
July ..	7·70	1	15	2	2	...	20	...	87.2	73·3	80·2	78·9
Aug. ..	4·34	2	6	4	...	...	12	...	87·5	73·8	80·6	78.7
Sept. ...	·60	1	2	...	...	...	3	...	90·1	74·7	82·4	73·9
Totals	12·64	4	23	6	2	...	35	...				
Means.	...	...	..	...	...	...	...	..	88·3	73·9	81·1	77.2
Onder-neeming.												
July ...	12·30	3	9	4	4	1	21	...	87·7	73·2	80·4	...
Aug. ...	9·26	...	3	7	1	1	12	...	88·7	73·6	81·1	...
Sept. ...	2·55	1	1	3	...	...	5	...	88·2	74·3	81·2	...
Totals	24·11	4	13	14	5	2	38	...				
Means.	...	...	...	...	...	...	...	...	88·2	73·7	80·9	...
Mora-whanna.												
July ...	4·08	11	14	1	...	...	26	...	...	...	..	...
Aug. ...	4·24	11	12	1	...	...	24	...	...	...	...	...
Sept. ...	2·83	9	8	...	1	...	18	...	...	...	...	...
Totals ...	11.15	31	34	2	1	...	68	...	...	...	...	...

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,206
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first nine months of 1925.

The corresponding figures for the same period during previous years and the average for the same period for seven years previous to that are added for convenience of comparison.

Product.	*Average 1916-22.*	*1923.*	*1924.*	*1925.*
Balata, cwts.	4,419	4,519	5,174	4,872
Cattle-food (Molascuit) tons	1,108	292	644	861
Cacao, cwts.	96	None	None	None
Cattle, head	263	806	252	429
Charcoal, bags	36,324	33,351	31,502	22,653
Citrate of Lime, cwts.	245	None	None	None
Coconuts, thousands	1,775	1,934	1,257	963
Coconut Oil, gals.	13,987	21,449	17,405	20,815
Copra, cwts.	1,094	4,968	13,511	10,552
Coffee, cwts.	4,013	4,559	4,579	5,231
Essential Oil of Limes, gals.	291	None	90	90
Firewood, Wallaba, etc., tons	5,787	5,861	5,132	4,607
Gums, lbs.	2,173	2,588	708	477
Hides, No.	4,769	4,580	7,174	7,620
Kola-nuts, cwts.	7	None	None	None
Lime Juice, gals.	6,064	3,581	3,361	5,474
Lumber, ft	161,436	94,121	93,508	111,256
Molasses, gallons	47,781	25,303	302,046	527,272
Pigs, No.	239	268	270	688
Railway sleepers, No.	10,517	6,716	11,802	30,591
Rice, tons	7,196	3,463	2,557	4,880
Ricemeal, tons	65	None	None	None
Rubber, cwts.	82	12	3	24
Rum, gallons	2,098,185	273,371	641,149	900,693
Sheep, head	33	26	35	10
Shingles, thousands	1,759	903	932	1,202
Sugar, tons	57,384	54,897	51,520	59,500
Timber, cub. ft.	74,797	100,296	135,095	146,975

The Journal
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

ISSUED QUARTERLY.

VOLUME XIX.

JANUARY, 1926—OCTOBER, 1926.

EDITED BY

C. L. C. BOURNE.

British Guiana.
PRINTED BY "THE DAILY CHRONICLE," LTD., GEORGETOWN

1927.

INDEX TO VOL. XIX.

1926.

A. Page.

Abelmoschus esculentus 30
Achras Sapota 47
Agaricus campestris 30
Agricultural Census Returns 170
Agricultural and Forest Products, Exports of— 77,159,241,314
Agricultural Research in Relation to the Community 13
Agricultural Shows 3
Allium ascalonicum 33
Allium Cepa 31
Allium Porrum 29
Allium Sativum 27
Amaranthus viridis 24
Amomum Grana-paradisi 42
Anacardium occidentale 39
Ananassa sativa 46
Annual Report of the B. G. Sugar Planters Experiment Station 1924-25 195
Anona Cherimolia 40
Anona muricata 48
Anona palustris 285
Anona reticulata 41
Anona squamosa 48
Antidesma Ghesaembilla 305
Apium graveolens 26
Arachis hypogœa Linn : ... 28,134,189
Areca Catechu 37
Artocarpus incisa 23
Artocarpus integrifolia 42

A.—(Contd.) Page

Artocarpus Lakoosha 43
Asparagus officinalis 21
Astrocaryum Tucuma 36
Astrocaryum tucumoides 37
Attendances at the Districts Gardens 78,160,243,316
Averrhoa Bilimbi 38
Averrhoa Carambola 39

B.

Bacterium pruni 193
Bambuse spp 21
Bertholletia excelsa 38
Bixa Orellana 37
Blighia sapida 36
Board of Agriculture, Meetings of the— 81,164,304
Botanical Notes 284
Boys' and Girls' Clubs 237
Brassica oleracea 24,29
Brassica rapa 35
Brassolis sophorae 300,302
British Guiana Farmers' Conference ... 247
British Guiana Sugar Planters Experiment Stations Committee, Resumè of Minutes of 16
British Guiana Sugar Planters Experiment Stations, Annual Report of the 195

C.

Canavalia ensiformis 22
Cane-Farming Competition, Report on East Coast— 8
Cajanus indicus 31
Capsicum annuum 31
Carica Papaya 45,285
Carum Petroselinum 31
Caryocar tomentosum 39,48
Caryophyllus aromaticus 40

C.—(Contd.) **Page.**

Castnia daedalus 301
Casuarina equisetifolia 286
Celosia cristata 24
Census Returns, Agricultural— 170
Chrysobalanus Icaco 41
Chrysophyllum Cainito 48
Cichorium Endiva 27
Citrus Aurantium 45
Citrus decumana 42,47
Citrus Limonum 43
Citrus medica 40,43
Citrus nobilis 45
Citrus vulgaris 45
Clidemia hirta Don. 305
Climate of British Guiana, The— ... 116
Coccoloba uvifera 42
Cochlearia armoracia 28
Cocos nucifera 40
Coffea arabica 37
Coffea liberica 43
Coix Lachryma-Jobi 29
Colocasia antiquorum 24
Colocasiae esculenta 27
Colocasia indica 28
Colocasia macrorhiza 34
Colocosia nymphaefolia 24
Cooking of Locally grown Vegetable Foodstuffs, The Preparation and— 52
Copraline, A Local Industry 180
Corypha umbraculifera 34
Cotton Seed Products to Farm Stock, Feeding— 147
Crotolaria juncea 284
Crotolaria striata 209
Cucumis citrullus 44
Cucumis Melo 44
Cucumis sativa 27
Cucurbita maxima 33
Cucurbita Pepo 31

C.—(Contd.) **Page.**

Cultivation of Garlic 143
Cultivation of the Ground Nut, The— ... 133
Cultivation of Onions 144
Cultivation of Tobacco, The— 308
Cyamopsis psoralioides 22

D.

Daucus Carota 25
Dioscorea alata 35
Diospyrus discolor 46
Dipteryx odorata 49
Dolichos Lablab 22
Dolichos sesquipedale 22
Dolichos sphaerosperma 31
Drought, The 187
Durability of Greenheart, The— 10

E.

Editorial Notes 245
Elaeis guineensis 36
Entomological Conference in London, Report on the— ... 100
Eriobotrya japonica 44
Eugenia malaccensis 44
Eugenia Michelii 48
Eugenia paniculata 43
Eugenia Pimenta 36
Eugenia vulgaris 47
Euterpe edulis 30
Exports of Agricultural & Forest Products 77,159,241,314

F.

Farmers Conference, British Guiana— ... 247
Feeding Cotton-seed Products to Farm Stock 147
Fibre Plants—Some— 284
Fire-wood 285

F.—(Coutd.) Page.

Flacourtia Ramonthii 47
Fluosilicates as Inseticides 190
Food Plants of British Guiana 18
Foeniculum vulgare 27

G.

Gardens, Attendances at District— 78,160,243,316
Garlic, Cultivation of 143
Goats 188
Glomerella cingulata 193
Glycine Soya 22
Greenheart, The Durability of— 10
Ground Nut, The Cultivation of the— ... 133
Guilielma Speciosa 45

H.

Helianthus annuus 188
Helianthus tuberosus 20
Hibiscus Sabdariffa 48
Hymenæa Courbaril 44
Hyospathe Elegans 178

I.

Ipomea Batatus 34

J.

Jottings 184

K.

Keeping qualities of Ripe Mangoes 145
Kola acuminata 43

L.

Lactuca Sativa 29
Laurus Cinnamomum 44

L.—(Cond.) Page.

Lentinus lepideus 10
Local Industry, Copraline A— 181
Luffa acutangula 28
Luffa cylindrica 28
Lycopersicum esculentum 35

M.

Malachra capitata 285
Malpighia glabra 38
Mangifera indica 44
Mangoes, The Keeping qualities of Ripe— ... 145
Manihot utilissima 25
Maranta arundinacea 20
Mammea americana 44
Mauritia flexuosa 285
Maximiliana regia 41,189
Meetings of the Board of Agriculture 81,164,304
Mentha viridis 30
Message to Farmers, A— 1
Meteorological Data 79,158,242,315
Meteorology and Agriculture 277
Metroxylon Rumphii 33
Mimusops globosa 37
Minerals in Live stock Feeding 295
Motor cultivation 188
Musa paradisiaca 46
Musa sapientum 38
Myristica fragrans 44

N.

Nelumbium speciosum 29
Nephelium Litchi 44
Nipa fruticans 30
Notes on Coconuts, Some Rough— 300

O. Page.

Obituary, Benjamin Gainfort 76
Obituary, Sir John Burchmore Harrison, C.M.G. ... 95
Obituary, Alfred Seton Milne 99
Ocymum basilicum 22
Oenocarpus Batawa 49
Onions, Cultivation of— 144
Oreodoxa oleracea 24
Oryza sativa 32

P.

Papain 285
Parrots as Pests 184
Passiflora laurifolia 48
Passiflora quadrangularis 42
Pentration of Fruits and Vegetables by Bacteria, etc. 194
Pereskia aculeata 38
Persea gratissima 37
Phaseolus lunatus 22
Phaseolus multiflorus 22
Phaseolus Mungo 22,27
Phaseolus vulgaris 22
Phoenix dactylifera 41
Phytolacca octandra 24
Pigeons 126
Pithecolobium dulce 40
Pithecolobium Saman 47
Plants of British Guiana, Food— 18
Portulaca oleracera 32
Preparation and Cooking of Locally grown Vegetable Foodstuffs, The— 52
Prevention of mould in Rubber 163
Principal Varieties of Sugar Cane in British Guiana under cultivation during 1924, 1925, 1926. 1
71
Proposed Government Fruit, Vegetables and Products Depôt, The— 161

P.—(Contd.) Page.

Psidium guyava 42
Psophocarpus tetragonolobus 22
Punica granatum 47

R.

Report on the Second Entomological Conference held in London in June, 1926, and Visit of Colonial Agricultural Officers to Rothamsted Experiment Station 100
Resumè of Meetings of the British Guiana Sugar Planters Experiment Stations Committee, October and November, 1925. 16
Retirement of R. Ward, M.B.E., The 287
Rubber Coagulants 276
Rubber, Prevention of Mould in— 163

S.

Saccharum officinarum 34
Salvia officinalis 33
Sechium edule 26
Sesbanea aculeata 205
Sesbanea aegyptiaca 285
Sesuvium portulacastrum 33
Shows, Agricultural— 3
Solanum Melongena 23
Sorghum saccharatum 26
Spondias dulce 42
Spondias lutea 42
Spondias purpurea 40
Sunflowers 188
Syzygium Jambolanum 43

T.

Tamarindus indica 48
Terminalia Calappa 37
Theobrome Cacao 39

(T.—Contd.) Page.

Thymus citriodorus 35
Tragium anisum 20
Typhoid Fly and Mosquitoes 185

U.

Urena lobata 284

V.

Vanilla planifolia 94
Vigna Catjang 13
Vigna repens 207
Vitis vinifera 42

W.

Wood Finishing 149

X.

Xanthosoma atrovirens 24

Z.

Zea, Mays 26
Zingiber officinale 41
Zizyphus Jujuba 41

INDEX OF AUTHORS OF ORIGINAL ARTICLES OR REPORTS.

Abraham, A. A. 3
Archer, T. A. 308
Beckett, Capt. E. 176,184,284,300
Bourne, C. L. C. 1,161,171,245
Bruce, S. N. 126,180
Cleare, L. D. 100
Harrison, Sir John 116
Lauchlan, A. D. E. 224
Mackay, M. S. 10
Whittles, Dr. C. L. 195

NOTICE TO AGRICULTURISTS.

POST OFFICE SAVINGS BANK.

A cash balance is a hall mark of the good farmer; it is also an essential of progress. It means, also, independence; for a well established balance in the Savings Bank does away with the discomforts and dangers of obtaining credit in order to plant and reap one's crops, and later the attendant evil of being compelled to sell the produce at a disadvantage. Remember that no profits are made by the Government on the moneys deposited in the Post Office Savings Bank as this Bank is intended solely as an aid in the practice of economy and thrift also—

Deposits are absolutely safe.

Any person may open an account.

A married woman may deposit in her own name.

A minor at the age of 14 may do so also.

Interest is paid on deposits up to $2,500. The rate of interest at present is 3 per cent.

A depositor may withdraw or deposit money at any Post Office.

JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XIX. JANUARY, 1926. No. 1

A MESSAGE TO FARMERS.

The two articles " Food Plants of British Guiana " and " The Preparation and Cooking of Locally Grown Vegetable Foodstuffs " which appeared in Vol. X, Nos. 3 and 4 of this Journal, have been revised and republished in this number by special request. At the time these articles were written (1917) the Colony was suffering not only from the high cost of foodstuffs but also from an actual shortage of certain articles of food. This state of affairs should have acted as an incentive to our farmers to extend the cultivation of fruit, vegetables, grains and pulses, at least to the extent of making the Colony self supporting ; instead of which we find that to-day, in so far as production is concerned, we are in the same position as that we held before the War. The average annual value of such imports as fresh and dried vegetables including onions and garlic, fresh fruits, beans, peas and lentils is in excess of half a million dollars, a large proportion of these imports being from our neighbours in the British West India Islands and Dutch Guiana. The statement by the writers of the original article still holds good that " These if planted in sufficient quantity under suitable conditions and properly tended would not only render this colony independent of any external supply of vegetable food but would leave a large surplus for export to other countries."

In October 1919 the Government started the vegetable products factory in order to induce farmers to increase the area under maize and to establish a better market for their rice and pulses by converting them into flour. The products from all these were excellent, but in spite of the considerable amount of energy and moneys devoted to the working of the factory, it had to be closed down after three years' trial, owing to the impossibility of obtaining sufficient supplies of corn or of pulses to keep the mill in working for more than a few months in the year, and also on account of the high prices demanded by farmers for their crops.

In recent years Government has spent considerable sums of money on improving the drainage of the coastlands of the colony, and farmers are now assured that their crops will not be destroyed by floods as occasionally happened in the past. This should certainly give them encouragement to extend their cultivations as far as their finances will permit. It is possible that lack of capital has been the main factor in preventing our farmers from attempting to raise crops which they have had no previous experience in cultivating. On this account we strongly advocate the proposed establishment of an Agricultural Loan Bank, and should this proposal meet with the approval of Government, it is for the farmer to show by increased production that he is worthy on this occasion of the confidence placed in him.

AGRICULTURAL SHOWS.

By A. A. Abraham, Horticultural Superintendent.

VICTORIA-BELFIELD AGRICULTURAL SHOW.

The Victoria-Belfield Agricultural Show was held on the 6th October, 1925. The show was disappointing from the paucity of its exhibits and led one to conclude that it was confined to Victoria and Belfield alone, with a small competition from Buxton. It seems never to be taken into consideration by villagers and farmers that shows are organized and encouraged by prizes as an incentive towards the extension of agriculture both in regards to field production and the preparation of the products.

This was the tenth show held at Victoria, and naturally one looks forward to these shows as a criterion to progress both in respect to quantity and quality. From an agricultural point of view, there was certainly a lack of enthusiasm towards the success of the show. As a matter of fact, exhibits were not handed in until the morning of the show.

Exhibits of the minor industries of the Colony such as Rice, Coffee and Cacao were very few. Of Sugar-cane there were only two exhibits. The display of Coffee and Cacao from the West Bank, Demerara, which was always a feature at the East Coast Shows, was entirely absent.

This Show was held under the Distinguished Patronage of E. M. Walcott Esq., F.R. who made some encouraging remarks in reference to the efforts of this Department to instruct, stimulate and render valuable assistance in the several districts of the Colony; and the speaker urged that the Department must have the co-operation of the farmers in its endeavours in order to show substantial results.

Class 'A'. There was one exhibit of fruit plants, and this did not even merit second prize.

Class 'B'. *Fruit section:* This was the poorest represented section. The only exhibit which deserved any special mention was that of Coconuts, which were placed in this class. The specimens were of good commercial standard, in view of which, extra prizes were given.

Class 'C'. *Vegetables.* The exhibits in this class on the whole were satisfactory from the point of view of quality. Pumpkins, Yams, Cassava, Tannias and Eddoes made up the major portion of this class. The Plantain exhibit was very poor, also Tomatoes.

Class 'D'. *Economic Products.* It is safe to report that only one-half of the entries which were displayed last year, was staged this year. The standard of the Guava jelly and local jams has certainly improved since the farmers competed in 1924 for extra prizes offered by the local committee of the Wembley Exhibition.

Class 'E'. *Poultry.* The exhibits were of the ordinary or creole ~~shame~~. Very little care was taken as regards preparing the birds for competition.

Closs 'F'. *Cattle.* A fair type of cattle was shown, and better care taken with the animals in presenting them for competition.

Class 'G'. *Needle and Fancy Work.* Even in this class there was an absence of keenness. The embroidery and fancy work shown were adjudged commendable. No plain needle work was exhibited.

WEST BANK FARMERS' JOINT AGRICULTURAL AND INDUSTRIAL SHOW.

The West Bank Farmer's Second Joint Agricultural and Industrial show was held on the 27th October, 1925.

The Show was held at Stanleytown Village this year and it was anticipated that by the change from Bagotville it would increase the number of exhibits and thereby the importance of the Show. This object was not achieved, as the Show did not come up to the standard of the one held at Bagotville on the 28th October last year.

This Second Joint Show, however, was of a decidedly better standard than that of Victoria-Belfield held on the 6th of the same month, both in respect to keenness and the number of exhibits.

Class 'B,' *Fruits*:—In this section there were 194 exhibits. Sweet Oranges were shown on a very large scale, there being 37 exhibits; and deserve special mention as regards quality. Shaddocks and Grape-Fruit were also good. There were no exhibits of the fruits mentioned on the Prize List, and others which were entered for competition, such as mangoes, Granadillas, Mammee Apple, and Guavas were exceedingly poor. Probably this was due to the trees not being in bearing at the time, coupled with the dry weather being experienced.

Class 'C,' *Vegetables*:—This was a very disappointing section as regards the quality and number of exhibits. This class was the poorest section of the Show and would lead to the conclusion that probably the present long spell of dry weather greatly retarded the progress of growing vegetable crops.

Class 'D,' *Economic Products*:—This section was well represented and was the redeeming feature of the Show. Creole Coffee, for which the Canals are noted, was well displayed and of very good quality. Cacao Pods, Beans, and prepared Chocolate ranked next in importance and these exhibits were also good. There was more competition in regards to padi and rice at this Show than that held at Victoria. The Starches and Meals were plentiful in number and well prepared. The excellent quality of the coconut oil exhibits attracted much attention and received favourable comment from the commercial gentlemen who were present.

Class 'F.' *Cattle*:—This section was small, but an exhibit of fair type of cattle was shown.

Class 'G.' *Forest Products* :—There was only one Palm Oil which was awarded 2nd prize.

The Show was opened by Mr. A. P. G. Austin, Manager of the Colonial Bank.

MAHAICONY AGRICULTURAL, INDUSTRIAL AND LIVE STOCK SHOW.

The second Agricultural, Industrial and Live Stock Show was held at Mahaicony on the 25th November 1925.

This Show was not up to the standard of the one held last year both in regards to the number of exhibits and in its educational value. Compared with Shows of the other districts, it was, however, of a higher standard than either the Show held at Victoria on the 15th October, or the one held at Stanleytown on the 27th of the same month.

The primary object of the holding of Agricultural Shows, which should be borne in mind by Agricultural Associations and farmers, is, that in addition to the exhibition of farm crops and their by-products, they should lead, by competition, to increased production of better agricultural produce.

Judging from the number of exhibts shown in the *Vegetable Section* it is evident that very little vegetables is, at present, being produced on the East Coast. This, however, may be partly due to former floodings complained of by the farmers, and to being hampered by the effects of the present continuous dry weather. There were only six exhibits of Plantains and the specimens were very poor. The most satisfactory exhibits in this section were Sweet and Bitter Cassava, Eddoes, Tannias, Buck Yams, and three exhibits of Sweet Potatoes. There was only one exhibit of Black Eye peas, which was awarded a special prize with the hope that it would be an incentive to extend the cultivation of this variety of legume. The sample was excellent. There were ten entries for the "Best Basket of Mixed Vegetables." In this lot there was keen competition. This was, however, no criterion that the vegetables were grown by the exhibitors; as a collection of these can be made by purchase. There were only two exhibits of Pumpkins. There were no exhibits of the following:—Tomatoes, Breadfruit, Onions, and Giant Plantains.

The Fruit Section, too, was not very encouraging. No doubt, the present dry weather is somewhat responsible for the dried up and shrivelled appearance of the Citrus fruits. Sapodillas, which were a noted feature both as regards size and sweetness at last year's Show, were exceedingly poor this year. There were two exhibits of Golden Apples, and two of Limes. The Golden Apples were fair, but the Limes poor. No exhibit of Avocado Pears was shown this year. There were nine exhibits of Sweet Oranges, and those which were awarded prizes were the produce of farms in the Canals, West Bank Demerara River. There were only three exhibits of coconuts this year, but these however, were very good specimens. The exhibits of Padi, five in number, were very fair, and showed that some progress is being made to produce a good product. There was a total of 145 exhibits in this section.

Class 'C' *Economic Section*: This section can, somewhat, be always relied on in making a show. The makers of Starches, Meals, Guava Jelly, and Colonial Pickles are becoming experts in preparing these commodities. It is a striking feature that these persons are residents of Victoria, Belfield, Golden Grove and Nabaclis. Although there were no exhibits of Guavas there were nine of Guava Jelly and six of stewed Guavas. Much improvement has been made in respect to the quality of the jelly and the method of exhibiting.

The Canals coffee-growers took a very keen interest in the coffee competition. There were six exhibits of Creole Coffee and five of Liberian. The samples were very good and carefully prepared. The exhibits of White and Brown Rice were of very good quality.

Class 'D.' *Live Stock*. This was a very poor section, being much below last year's standard. No special interest was shown and practically no competition. The exhibits were as follows, 1 Milch Cow, 1 Heifer, 1 Bull and 2 working Steers.

This Show was opened by Mr. J, Wood Davis.

REPORT ON EAST COAST CANE-FARMING COMPETITION.

BOTANIC GARDENS,
GEORGETOWN,
16TH NOVEMBER, 1925.

SIR,

We have the honour to submit the following report on the results of the judging of the East Coast Farmers' Competition Plots at Buxton-Friendship, Victoria, Nabaclis—Golden Grove and at Beterverwagting—Triumph, which was held on the 10th, 11th, 12th and 13th instant.

Buxton—Friendship. The plots entered at this section consisted chiefly of plantains, with some cassava. There were four (4) entries at Buxton and four (4) at Friendship. The plantains have been growing on the beds for a number of years and do not appear to have received any careful cultivation for some time. They have been allowed to sucker profusely without control, thereby affecting the proper development of the produce. The soil, too, is worn out from repeated cropping of root-crops in former years. This is apparent by the stunted growth of many of the plantains seen. Apparently no special efforts have been made to improve or maintain the fertility of the soil by mulching and the cultivation of legumes etc. Under the circumstances we are unable to recommend any of the plots in this division for prizes.

Victoria—Nabaclis and Golden Grove. Of the eight entries submitted for judging in this section, two were withdrawn on the day of inspection. The farmers whose plots were judged have paid careful attention to the cultivation of their crops, and have put into practice agricultural advice given them. Their crops are unfortunately suffering severely from the continuous dry weather.

The following table gives the results of the judging at this section, the awards being made under the following headings.

Condition of cultivation and tillage	50	marks
Condition of drainage	50	,,
	100	

Name.		Village.	Crops.	General Cul'v'ion	Drainage.	Total.	Prizes. $ c.
Prince Cuffy	...	Victoria	Cassava	45	40	85	15.00
Hamlet Collins	...	,,	Mixed	50	30	80	12.00
Thos. Cuffy	...	,,	,,	40	35	75	10.00
Robt. Benn	...	,,	Cassava	30	35	65	5.00
G. Cockfield	...	Nabaclis	Mixed	45	45	90	18.00
A. C. Baptiste	...	,,	,,	40	40	80	12.00

Beterverwagting—Triumph. We regret to report that farming at this section has declined. The entries last year were six (6), this year only five (5) plots were entered, and of these, two were struck out on account of their neglected appearance. The results of the judging at this division are as follows :—

Name.	Village.	Crops.	General Cul'v'ion	Drainage.	Total.	Prizes. $ c.
M. V. Fernandes ...	Triumph	Mixed	40	40	80	12.00
Chas. Rodney ...	B'verw'ting	,,	40	35	75	10 00
Samuel Andries ...	,,	,,	35	30	65	5.00

We have the honour to be,
Sir
Your obedient servants,
(Sgd.) A. A. Abraham,
Horticultural Superintendent.
C. C. Dowding,
Res. Agl. Instructor, E.C.
H. B. France,
Agricultural Assistant.

Director of Science and Agriculture.

THE DURABILITY OF GREENHEART.

By M. S. Mackay, Assistant Conservator of Forests.

In July 1915 Mr. C. J. Humphrey, Pathologist to the Forest Products Laboratory, Madison, Wisconsin, published a most instructive article *entitled " Tests on the Durability of Greenheart". In this paper he gave tabulated results of his experiments in infecting the heartwood and sapwood of Greenheart with various wood-detroying fungi. The great durability of this timber is well-known, and Mr. Humphrey attributes it to two factors:—

(i) The presence of tyloses, stuffing the vessel or pores and rendering them more difficult of penetration by the fungus mycelium.

(ii) The presence of certain alkaloids in the wood, with some preservative effect.

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* "Tests on the Durability of Greenheart" "Mycologia" Vol. VII. No.4.

The presence of alkaloids has been proved, but that they have any preserving effect on the timber still remains uncertain. The presence of tyloses does not appear to be constant. In that magnificent manual "Timbers of Tropical America" Professor Record and Mr. C. D. Mell make no mention of tyloses in the vessels of Greenheart wood. Gum however does occur in the vessel and this may have some effect in the preservation. Whatever the reason may be the fact remains that Greenheart maintains its world-wide reputation for extreme durability. Mr. Humphrey submitted test blocks of Greenheart to the action of 24 different wood-destroying fungi, and found the heartwood to be very highly resistant and, in the majority of cases, practically immune, notwithstanding the fact that the fungoid organisms grew luxuriantly in the tubes containing the test blocks.

In 1916 Mr. Humphrey published the first of a series of papers† on the relative resistance which different American timbers offer to different fungi. In this article he gives the results obtained from flask tests on conifers. The work was begun at the Forest Products Laboratory about 3 years ago, on material collected from all parts of the U.S.A., and both heartwood and sapwood were secured whenever possible. Tests were carried out on 28 species of conifers, using only one specimen of wood for three different test periods. The very destructive and vigourously growing fungus, *Lentinus lepideus Fr.*, abundant on conifers over almost the whole of the U.S.A., was selected for this first series of tests on account of the vigour with which it rots many species of conifers in nature.

Without going into the method used by Mr. Humphrey, or the minor details of his experiments, a table of his results, showing the different effects on the different timbers after one year's submission to the action of *Lentinus lepideus* will suffice to give some idea of the great superiority of Greenheart.

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† "Laboratory Tests on the Durability of American Wood" - I. "Mycologia" Vol. VIII. No.2, March 1916.

Kind of Wood.	Oven-dry Weight in Grams.		Loss in Weight per cent.	Remarks.
	Before test.	After test.		
Eastern Hemlock	7.85	3.17	59.6	Friable when dry.
Mountain Hemlock	8.61	3.08	64.2	...
Western Hemlock	7.94	3.08	61.2	...
Englemann Spruce	7.23	2.27	68.6	...
Stika Spruce	4.33	1.63	62.4	...
Red Spruce	7.07	2.30	67.5	...
White Spruce	5.62	1.70	69.8	...
Grand Fir	7.10	2.12	70.1	...
Noble Fir	7.53	2.25	70.1	...
European Larch	7.88	4.50	42.9	Well rotted.
Western Yellow Pine	7.60	3.35	55.9	Friable when dry.
Lodgepole Pine	6.93	2.47	64.4	...
Longleaf Pine	11.42	5.59	51.1	...
Shortleaf Pine	12.25	9.72	20.7	Seriously rotted in the summer wood.
Table Mountain Pine	10.22	6.17	39.6	Friable when dry.
Norway Pine	8.00	2.45	69.4	...
White Pine	6.71	6.12	8.8	Slightly rotted.
Sugar Pine	6.06	2.55	57.9	Friable when dry.
California Juniper	10.66	10.31	3.3	Slightly affected
Bigtree	7.07	4.59	35.1	Seriously rotted.
Greenheart	17.16	17.12	...	Not appreciably affected

The percentage loss in weight of Greenheart was below five per cent. and is not given as they may lie within the experimental error. Douglas Fir, Pitch Pine and several other species became too wet during the experiment for a fair test to be made.

With these figures before one it is depressing to think of the number of uses to which American lumber is put in Georgetown; in perference to Greenheart timber for which British Guiana is the world's only source of supply. It seems unreasonable that people should have their wood imported from afar when vastly superior timber is to be found almost at their doors.

It is hoped that Mr. Humphrey will soon publish his tests on American timbers and give to the timber world the added knowledge consequent on his most thorough and pains-taking researches.

One may confidently expect, however, that these researches will uphold, if not materially strengthen, the claims of GREENHEART to be durable above all other timbers.

AGRICULTURAL RESEARCH IN RELATION TO THE COMMUNITY.*

It is a common reproach that agriculturists have not made the same use of science as have those engaged in the other great industries—that farming is still a rule of thumb process carried out by methods which have their origin in the dark backward and abyss of time. In some respects this is indeed true. One has only to read Cato or Columella to realize that the Italian peasant of to-day is working and living in very much the same way as his Roman forebears, and even the more highly organised farming of Great Britain or Denmark or Holland is carrying on many of the essential operations of cultivation on lines that were laid down by the first great civilizers—the Romans. It is easy in fact to trace modern agriculture to a Roman ancestry; in Britain, for example, by the trans-plantation from the fifteenth century onwards of the traditions and practices that persisted through the dark ages in the Low Countries.

None the less progress has taken place and scientific development is going on. Under medieval systems of agriculture the yield from England's land was of the order of six to eight bushels of wheat to the acre........ Latterly we have seen the yield creeping up a little through the introduction of heavier cropping wheats—the products of scientific research.

Great are the achievements and still greater the possibilities of agricultural research, but we must recognize that there are limitations to the effect of science upon agriculture which do not hold for the other industries. In the first place, in agriculture we are dealing with a living organism and the amount of control that we have obtained over plant or animal, over that stubborn essence we call life, is far less than we can exercise over inanimate nature, over iron or cement, or even the ether or the atom.... We see no way of growing three or four crops a year under temperate climate conditions. The organisms we are dealing with will go through their cycle and you can not hurry them. When you start hustling you find you let in secondary troubles of all sorts.

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*An address delivered by Sir A. D. Hall before the Graduate School of the U.S Department of Agriculture, January 26, 1925.

These limitations lie in the nature of things, and though on looking back we can count up the immense advances that agriculture owes to the application of knowledge we must not hope for sudden development or revolutionary changes such as have been seen in flying or wireless telegraphy. In fact for the time being I am bound to say that agriculture is actually suffering from the rapid developments and scientific achievements that have distinguished other industries. I say this advisedly and most solemnly. Agriculture is the fundamental industry, because we must all be fed, and yet you cannot point to any part of the world where agricultural wealth is being turned out and find the producers in a flourishing condition.

The only hope I can see at present for large-scale production, for organized industry on the land, lies in the advances that science can make. It is research alone that will enable the big agricultural business to compete with the excessive labour of the one-man farm, to pay wages and give conditions of life to its work-men equal to those prevailing in the urban industries. It becomes then a matter of the first import to the growth of civilization itself, not merely to agriculture, that agricultural research should be encouraged.

We may consider research from two points of view. In the first place, it is an intellectual affair carried out by the individual in response to the insatiable curiosity of the mind about its surroundings and its own existence. As such, it proceeds from an artistic impulse, it is not under control and it is not amenable to considerations of utility. Just as some men must write poems or paint or make music, as other men find themselves compelled to speculate, to become philosophers or metaphysicians, so similarly the class of men we are considering must investigate nature.

So far I have only been considering research from its intellectual side as a response to man's curiosity, but the nineteenth century proved it had also a practical side inasmuch as it led to an enormously increased control over the forces of nature. I need not sing the praises of what has been effected by steam, by electricity, by modern medicine; willynilly the results are being incorporated in our daily life. Research leads to efficiency, and efficiency is a means of making money. The modern state must cultivate research if it is to become efficient and survive in the world's competition; hence all are agreed now on the endowment of research, and since in farming there are no great business corporations agricultural research must for many years to come be maintained by the state.

If then, research is to become of such importance to the state, it behoves us to ensure conditions for the research worker under which discoveries are likely to be produced. To do this properly we must understand the psychology of the investigator. If it is true that research, like art, grows by a process of intuition, we can no more organize it into existence than we can organize the output of poetry. Nor are we likely to obtain it by a system of prizes, of rewards, commensurate to those obtained in the great professions, in industry or commerce. What we can do is to contrive sheltered places in our community in which research workers can live. We can not guarantee results, but we may wait in faith because, as we have said, the impulse to make discoveries is fundamental in man's mind. Now the sheltered places in which the research worker can live are the universities.

One last word, the state must have research in order to obtain efficiency, but does mankind really care about efficiency? At bottom man does not, he wants to "loaf and possess his soul." Efficiency is a beautiful word, but efficiency to what end? If pursued for its own sake it may become a curse.—*Science.*

RESUME OF MINUTES OF MEETINGS OF THE BRITISH GUIANA SUGAR PLANTERS EXPERIMENT STATIONS COMMITTEE FOR OCTOBER AND NOVEMBER, 1925.

The Committee met on Monday, the 26th October, 1925, when the following were present:—Sir John Harrison, Chairman; The Hon. W. M. B. Shields, Messrs R. Strang, D. Clark, R. P. Daggett with the Superintendent and Secretary.

The monthly statement of receipts and expenditure having been passed, the Chairman mentioned that owing to the strict economy exercised at the Station, the expenditure was considerably less than estimated. Some discussion ensued as the object for which the station was conducted. The meeting again decided that the station was primarily for the raising of seedlings with a view of obtaining a better cane than the D.625 and that work in connection wih mechanical tillage could be conducted on the estates where better facilities offered.

The Superintendent stated that about 30 to 40 of the seedlings produced in 1922 showed promise. Arrows were being collected from these and would be sown in due course.

The Committee met again on the 23rd November when the following attended:—Sir John Harrison, Chairman; Hon. W. M.. B. Shields, Messrs. G. E. Anderson, R. Strang, A. E. Craig, W. S. Jones and the Superintendent and Secretary.

The Chairman read portions from Mr. Stockdale's speech in the "Ceylon Observer" relative to the establishment of a Tea Research Institute. At the request of the members present the Chairman promised to have extracts typed and circulated to them.

The reports of the Superintendent, Chemist and Field Manager having been circulated were discussed. The estimates of expenditure at Sophia for November were approved and the monthly statement of receipts and expenditure noted. As regards the weather, the Chairman remarked that the indications were for a prolonged drought. He had recently compiled an Abstract of the Observations on the Climate of British Guiana from 1846 to date and would send copies to each of the members.

A letter from the Field Manager to the Superintendent concerning the condition of tops sent to Pln. Anna Regina was noted; the Chairman promised to deal with the matter at the meeting of the Essequebo Land Settlement Committee that day.

The Committee decided with regret to dispense with the services of its Field Manager, Mr. J. P. Bastiaans, the latter having become incapacitated through ill health. He was granted an extension of three months half pay leave to the end of December.

The Chairman mentioned that he had recently prepared certain information for the use of the East Indian Immigration Commissioner which might be of interest to the members, and promised to have copies made for circulation to them.

The Superintendent was granted one month's leave of absence to go to Barbados in March for the benefit of his health.

The Chemist was granted similar leave in December.

FOOD PLANTS OF BRITISH GUIANA.

By Sir John B. Harrison, C.M.G., M.A., Director; and the late C. K. Bancroft, M.A., F.L.S.; Assistant Director, of the Department of Science and Agriculture.

This colony lying between latitude 0° 41′ N. and 8° 33′ 22″ N., has a depth from North to South of about 500 miles, a seaboard of about 270 miles and occupies in the north-east of South America an area approximately equal to that of Great Britain.

The chief agricultural industries are sugar, rice cacao, coffee, coconuts, rubber; limes and ground provisions. The principal exports derived from these are sugar and its by-products (rum, molasses and molascuit) rice, coffee and coconuts. But in addition to the plants from which this produce is obtained there are a large number of species well suited both to the soil and the climatic conditions of the colony, which would repay cultivation on a much larger scale than exists in the colony at the present time. British Guiana imports large quantities of foodstuffs of vegetable origin, prominent among which are grain and flour, ground provisions of various kinds, more particularly potatoes, both ordinary and sweet, pulses, fruit; cattle foods; etc.

In the following pages of this article will be given a list of the food plants occurring in British Guiana with short notes on their uses. These, if planted in sufficient quantity under suitable conditions and properly tended would not only render this colony independent of any external supply of vegetable food, but would leave a large surplus for export to other countries. The plants are dealt with under two heads, *viz.*, I., Field Crops, Vegetable and Miscellaneous Plants, and II. Fruits and Spices.

EXPRESSION OF FOOD VALUE.

The difference in the capacity of different foods for yielding heat or energy renders it desirable to express the fuel or food value of each either in terms of an absolute unit, as the calorie, or in terms of an arbitrary expression dependent on the relative proportions in which the nutritive constituents are present. In the former case the fuel value is the amount of heat, expressed in calories, equivalent to the energy which could be obtained if all of the nutrients present were thoroughly digested. The latter are usually expressed as "Nutritive Ratio" (N.R.) by which is meant the proportion that the sum of the starch or carbohydrate content and two and a half times the fat content bears to the crude protein content taken as unity, $\frac{\text{Carbohydrate} + 2.5\ \text{Fat}}{\text{Protien.}}$ "Fat Ratio" (E.R.), the proportion that the starch or carbohydrate content bears to the fat content taken as unity, *i.e.*, $\frac{\text{Carbohydrate}}{\text{Fat}}$: "Food Units" (F,U.) the sum of the starch or carbohydrate content added to two and a half times the sum of the fat and protein content, *i.e.*, Carbohydrate + 2·5 (Fat + Protein).

The value of a calorie in terms of Rubner's units (R.C.) is obtained by multiplying the sum of the Protein and Cardohydrates dy 4.1 and adding the result to the Fat multiplied by 9.3, *i.e.*, 4.1 (Carbohydrate + Protein) + 9·3 Fat.

Wherever it has been possible to do so the fuel value and the other values mentioned above have been included in this article. The most valuable of these expressions are the fuel value in Rubner calories and the "Nutritive Ratio."

I.

FIELD CROPS, VEGETABLE AND MISCELLANEOUS PLANTS.

Aniseed : *Tragium anisum.* An annual herb, native of Egypt, employed for garnishing dishes, grown in kitchen gardens, but only in small quantity. It is propagated from the seed, which may be sown in a box or pan. The young plants when strong enough may be transplanted into a bed about six inches apart.

Arrowroot: *Maranta arundinacea.* A perennial herb native of tropical America, growing to a height of about three feet, possessing fleshy rhizomes from which the arrowroot of commerce is obtained. Although it is not cultivated now in British Guiana to any appreciable extent, there was some fifteen years ago a cultivation of fair size on the West Coast of Berbice. The plant requires a light well-drained soil. A return may be expected eleven months after planting. The rhizomes contain about 20-25% of starch, but little more than 15-18% is usually recoverable, yielding 7 cwt. of arrowroot per acre. Under very favourable conditions this return may be doubled.

The average compositions of the arrowroot plant and starch are:—

	Plant	Starch
Moisture	63.4 ..	13.6
Protein	1.6 ..	.9
Fat	.2 ..	.3
Starch, Sugar, etc. ..	30.0 ..	84.6
Fibre	3.9 ..	.3
Ash	.9 ..	.3
N.R.	19.0 ..	9.5
F.R.	150.0 ..	282.0
F.U.	34.4 ..	88.0
R.C.	131. ..	353.

Artichoke: *Helianthus tuberosus.* The Jerusalem artichoke is the tuber of a perrennial sun-flower-like plant, native of Canada and the middle parts of the

United States of America. The tubers may be cut to single eyes and planted like a potato. The plant requires a friable loamy soil for its successful cultivation. A crop can be obtained three months after planting. The composition of the tuber is:—

Moisture	80.0
Protein	2.0
Fat	.5
Starch, Sugar, etc.	14.4†
Fibre	2.0
Ash	1.1
N.R.	7.8
F.R.	28.8
F.U.	20.6
R.C.	72.

Asparagus (*Asparagus officinalis.*) A perennial erect herb, said to be indigenous to Europe and Asia, growing to a height of 3–4 feet, cultivated for its young tender shoots. In kitchen gardens, on loose soil it makes a fair growth, but the shoots seldom attain a satisfactory size.

Asparagus Bean—see Bean, Yard.

Bamboo: *Bambusa* spp. The young shoots of some species are used in making pickles and chutney.

The seeds of *Bambusa arundinacea* have been employed in India on several occasions to substitute a deficient millet or rice crop. Their composition when husked is:—

Moisture	11.0
Protein	11.8
Fat	.6
Starch, Sugar, etc.	73.7
Fibre	1.7
Ash	1.2
N.R.	6.4

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† Sugar, inulin and levulin.

F.R.	122.8
F.U.	104.7
R.C.	356.

Basil : *Ocymum basilicum.* Said to be native of the East Indies. Useful for seasoning, like sage or thyme. The seed should be sown in boxes and the young plants transplanted to a well-drained bed.

Beans—Bonavist : *Dolichos Lablab.* Annual or perennial twining vines. The most useful is a small annual. The beans are employed as a vegetable.

Dholl : *Phaseolus Mungo.* The green pods and ripe seeds are eaten.

Beans—Goa : *Psophocarpus tetragonolobus.* A perennial climber bearing fruit from 9-10 inches long, each with four wings. The pods when immature are sliced and cooked like French or Kidney beans. Introduced into the colony from India.

Guar : *Cyamopsis psoralioides.* A robust annual, probably native of India. The pods are employed in the same manner as the above.

Kidney or French : *Phaseolus vulgaris.* An annual, cultivated for its edible pods which are used as a vegetable when immature. Several varieties occur.

Lima: *Phaseolus lunatus.* A robust annual, cultivated for its edible seeds.

Scarlet Runner : *Phaseolus multiflorus.* A perennial climber whose pods are used like those of the Kidney bean.

Soya : *Glycine Soya.* A sub-erect annual herb, native of Southern Europe, cultivated for its edible seeds.

Sword : *Canavalia ensiformis.* An annual climber, the ripe seeds and immature fruit of which are employed as vegetables.

Yard Long *Dolichos sesquipedale.* An annual climber sub-erect, with flexuose stems. The immature fruit and seeds are eaten as a vegetable.

The above beans yield returns in from three to six months. They are the commonest beans suitable for cultivation in kitchen gardens in the colony. There are several others cultivated in tropical countries which may with advantage be grown in this colony, such as Sutri (*Phaseolus calcaratus*) Tepary (*Phaseolus acutifolius*), Moth (*Phaseolus aconitifolius*) Ngena (*Phaseolus* sp.), Horse (*Dolichos biflorus*), Velvet (*Stizolobium aterrimum*) Bambarra (*Voandzeia subterranea.*)

The following table shows the composition and the food value of some of them :—

	IMMATURE PODS.	BEANS.				
	Kidney.	*Bonavist.*	*Dholl.*	*Lima.*	*Soya.*	*Sword.*
Moisture	89·8	14·6—12·1	10·8	13·3	10·3	12·6
Protein	2·4	17·1—22·4	22·2	19·7	43·6	25.0
Fat	·4	1·4—2·3	2·7	1·2	15·5	2·8
Starch, Sugar etc.	1·8	53·5—57·4	54·1	57.8	21·0	48 6
Fibre	4·8	5·0—6·5	5·8	4·3	4·4	7·7
Ash	·8	3·4—3 7	4·4	3·7	5·2	3·4
N.R.	1.2	3·3—2·8	2·7	3·1	1·4	2·2
F.R.	4·5	38·0—25·0	20·0	48·2	1·4	17·3
F.U.	8·8	99·8–122·3	116·4	109·9	168·7	118 1
R.C.	21·0	300·—351·	338·	329·	409·	328.

Boulanger : *Solanum Melongena.* An erect, herbaceous annual, 2-3 feet tall, bearing roundish-oblong purplish fruits, forming an important vegetable in this colony. Grown readily from seed. The plant requires a friable loamy soil.

Breadfruit : *Artocarpus incisa.* A native of the Pacific Islands grown in fair quantity in the colony. An evergreen tree bearing large round fruits employed as a vegetable. The tree is best grown on a friable soil of good depth. The compositions of meal and flour made from the fruit are as follows :—

	Meal	*Flour*
Moisture	12.1-13.9	14.3
Protein	3.5- 5.3	1.0
Fat	1.3- 1.4	.2
Starch, Sugar, etc.	77.1-61.6	83.8
Fibre	4.0-14.8	.2
Ash	2.0- 3.0	.4
N. R.	24.2-12.3	84.3
F. R.	6.0-44.0	419.0
F. U.	89.0-78.4	86.8
R. C.	342. -287	390.

Cabbage. *Brassica oleracea.* A biennial herb, native of Europe, grown as an annual for its succulent leaves which form a "head." The composition of the shoots and leaves is:—

	White.	*Red.*
Moisture	90.1	90.0
Protein	1.8	1.8
Fat	.2	.3
Starch, Sugar, etc. ...	2.8	2.5
Fibre	3.9	4.6
Ash	1.2	.8
N.R.	1 83	1.77
F.R.	14.0	8.3
F.U.	7.8	7.7
R.C.	21.	20.

Cabbage Palm: *Oreodoxa oleracea.* A tall erect palm whose immature inflorescences are used in the making of pickles.

Calalu. Giant cockscomb: *Celosia cristata,* var. *major.* An erect herb growing from 3-4 feet high. The young leaves are employed as a spinach. It is said to be the best of all calalus.

Green: *Amaranthus viridis.* An erect herb occurring in two varieties, a larger and a smaller. The tops of the shoots are used as a spinach.

Indian Kale: *Xanthosoma atrovirens.* A low-growing perennial. The young leaves are used as a spinach.

Kale: *Colocasia nymphaefolia.* Similar to the above.

Spanish: *Phytolacca octandra.* A succulent plant with a trailing stem employed as a spinach.

Water: *Colocasia antiquorum.* Similar to Kale.

The compositions of the shoots of Indian Kale and Spanish Calalu are:—

	Indian Kale	*Spanish Calalu*
Moisture	89.4	95.5
Protein	2.5	1.1
Fat	.8	.2
Starch, Sugar, etc. ...	4.6	1.7

Fibre	1.1	.3
Ash	1.6	1.2
N.R.	2.6	2.1
F.R.	5.7	8.5
F.U.	12.9	4.9
R.C.	36.	13.

Carrot: *Daucus Carota.* A biennial herb, native of Europe, cultivated as an annual for its edible roots. The plant is best grown on a loose friable or sandy loam.

Carrot roots have the following composition:—

Moisture	90.3
Protein	1.2
Fat	.3
Starch, Sugar, etc.	4.6
Fibre	2.6
Ash	1.0
N.R.	4.4
F.R.	15.3
F.U	8.3
R.C.	26.

Cassava: *Manihot utilissima.* A perennial, woody herb, growing with an erect stem up to 9 feet in height, native of tropical America, cultivated for its tuberous roots from which bread, starch and other products are made. It is one of the principal sources of carbohydrate food in the colony. A crop is obtained in 6–8 months, and produces 4-8 tons of tubers per acre. There are two kinds, the "bitter" and the "sweet." The former is more hardy and gives the higher returns per acre. The compositions of cassava and its products are:—

	Roots.	*Meal, dried.*	*Chips, Kiln dried.*	*Bread.*	*Starch.*	*Bitty.*	*Tapioca.*
Moisture	64·4	11·4	·6	10·2	15·8	10·9	13.7
Protein	1·4	2·1	1·3	1·3	·4	3·6	.5
Fat	·4	1·1	1·6	·6	·2	·7	·3
Starch, Sugar, etc.	30·4	82·1	91·8	81·9	83·4	76·0	84.1
Fibre	2·7	1·8	2·9	4·8	...	6·1	·7
Ash	·7	1·6	1·8	1·1	·2	2·7	.7
N.R.	22·4	40·4	73·7	64·3	192·0	21·7	184·4
F.R.	76·0	74·6	51·1	131·7	417·0	108·6	280·3
F.U.	34·9	90·1	99·9	86·8	85·6	86·8	86·0
R.C.	134	355	383	348	345	333	348

Celery: *Apium graveolens.* A biennial herb, native of Europe, cultivated for its leaf-stalks which are eaten cooked or uncooked.

Chrystophine: *Sechium edule.* A perennial climber bearing furrowed fruits, 3-4 inches long, employed when immature as a vegetable.

Corn. Guinea: *Sorghum vulgare.* An annual grass, native of India, extensively cultivated in the West Indies but only in very small quantity in British Guiana. The high food value of the grain renders it an important article of food in several countries in the world. A good average return from an acre is 50 bushels of grain. It gives a crop in about five months. Although it will give good returns on a wide range of soils, it thrives best on a loose friable one. An average composition of the grain is:—

	Not Hulled.	*Hulled.*
Moisture	10.5	12.0
Protein	7.5	8.0
Fat	1.6	2.0
Starch, Sugar, etc. ...	67.4	76.4
Fibre	9.0	1.0
Ash	4.0	1.0
N.R.	9.5	10.1
F.R.	42.1	38.0
F.U.	90.1	101.0
R.C.	322	362

Imphee: *Sorghum saccharatum.* One of the millets closely allied to the above.

Indian or Maize: *Zea Mays.* An annual grass, whose grain is an important article of food in several parts of the world. It yields a crop in 4 months of 16-25 bushels per acre. The following are average compositions of maize products:—

	Flour.	*Meal.*	*Cornflour (Starch).*	*Bran.*
Moisture	12·6	9·7	14·1	12·5
Protein	8·7	12·7	·9	9·9
Fat	2·0	1·2	1·2	3·6
Starch, Sugar etc,	74·7	74·5	83·6	61·5
Fibre	1·0	·3	·1	9·5

Ash	1·0	·6	·1	2·8
N.R	9·2	5·9	96·2	7·1
F.R.	37·3	62·1	70·0	17.1
F.U.	101·7	106·2	88·8	95·3
R.C.	361	356	357	326

Cucumber: *Cucumis sativa*: A herbaceous climber, probably native of the East Indies, cultivated for its fruits which are used as a vegetable when immature.

The composition of the immature fruit is:—

Moisture	96.5
Protein	.5
Fat	.2
Starch, Sugar, etc.	1.5
Fibre	.8
Ash	.5
N.R.	4.0
F.R.	7.5
F.U.	3.2
R.C.	10.

Dholl.—see Bean, *Phaseolus Mungo.*

Eddoe.—*Colocasia esculenta*: A perennial herb, native of India, cultivated as an annual for its rhizomes which are starchy. It yields a crop in 5-6 months of 1½ to 2 tons of tubers. An average composition of the tubers is:—

Moisture	91.6
Protein	.3
Fat	.1
Starch, Sugar, etc.	5.0
Fibre	1.7
Ash	1.3
N.R.	17.7
F.R.	50.7
F.U.	6.0
R.C.	22.

Egg-plant.—see Boulanger.

Endive.—*Cichorium Endiva*: An annual herb grown for its leaves which are employed in a similar manner to lettuce in making of salads.

Fennel.—*Foeniculum vulgare*: A perennial, native of Europe, employed for garnishing dishes like parsley.

French Bean.—see Bean, French.

Garlic.—*Allium sativum*: A perennial herb, cultivated for its bulbs which are employed for seasoning.

Giant Cockscomb.—see Calalu.

Ginghee.—*Luffa acutangula*: A herbaceous climber, producing green fruits which are eaten as a vegetable when immature in a similar manner to squash.

Goa.—see Bean.

Gourd.—*Luffa cylindrica*: Similar in appearance and uses to Ginghee.

Green Calalu.—see Calalu.

Ground Nut.—*Arachis hypogœa*: An annual herb, grown for its oily seeds. And oil used in cooking is expressed from the seeds. The yield per acre of shelled seed is about ½ to ¾ ton, a crop being obtained 4—5 months after planting. The composition of the seed is:—

Moisture	7.5
Protein	27.5
Fat	44.5
Starch, Sugar, etc.	15.7
Fibre	2.4
Ash	2.5
N.R.	4.6
F.R.	.3
F.U.	195.6
R.C.	591.

Guar Bean.—see Bean.

Guinea Corn.—see Corn.

Hog Tannia: *Colocasia indica*: Similar to the Tannia, but stronger and coarser in growth and with a bare stem of 2 to 3 ft. high. The plant does not produce many tubers. The whole stem is used for food. The composition of the root-stock is:—

Water	91.56
Oil, Fats	.08
Albuminoids	.27
Sucrose	trace.
Glucose	.36
Starch	.94
Gums, Pectose, etc.	1.11
Fibre	4.49
Ash	1.19

Horse Radish.—*Cochlearia Armoracia*: A perennial herb, native of Europe, cultivated for its fleshy roots which are employed for garnishing dishes.

Imphee.—see Corn.

Indian Corn.—see Corn.

Job's Tears.—*Coix Lachryma-Jobi*: An annual grass, 3 to 5 feet high, bearing hard rounded grains. The food value of the grains husked is shown in the following table:—

Moisture	15.8
Protein	18.8
Fat	6.2
Starch, Sugar, etc.	59.6
Fibre	1.3
Ash	3.4
N.R.	4.1
F.R.	9.6
F.U.	125.2
R.C.	379.

Kale.—see Calalu.

Kidney Bean.—see Bean.

Kohl-Rabi.—*Brassica oleracea* var. *caulo-rapa*: A biennial, cultivated as an annual for its fleshy underground stem which is employed as a vegetable. The composition of the tuber is:—

Moisture	86.7
Protein	2.9
Fat	.3
Starch, Sugar, etc.	8.3
Fibre	.6
Ash	1.2
N.R.	3.1
F.R.	27.7
F.U.	16.2
R.C.	49

Leek.—*Allium Porrum*: A perennial herb, native of Europe cultivated as an annual for its fleshy leaves and stems.

Lettuce.—*Lactuca sativa*: A herbaceous annual whose succulent leaves are used in making salads and for similar purposes.

Loofah.—see Gourd.

Lotus.—*Nelumbium speciosum*: A perennial herb, aquatic, bearing large seeds embedded in a cone-shaped fruit. The seeds are either eaten raw when immature or roasted when ripe.

Their composition is:—

Moisture	12.2
Protein	17.7
Fat	2.4
Starch, Sugar, etc.	62.2
Fibre	1.7
Ash	3.8
N.R.	3.9
F.R.	25.9
F.U.	112.5
R.C.	350.

Manicole.—*Euterpe edulis*: A medium-sized palm whose terminal bud or "cabbage" is employed as a vegetable. It is of common occurrence near water-courses in several parts of the colony.

Mint.—*Mentha viridis*: A perennial herb, native of Europe, whose leaves are employed for flavouring purposes.

Mushroom.—*Agaricus campestris*: An edible fungus. A small variety may commonly be found in fields at certain periods of the year. It is of good flavour.

Nipa.—*Nipa fruticans*: A low growing swamp palm with large leaves, yielding a sap obtainable from the young inflorescence from which sugar and a spirit known as "arrack" are made.

Okra.—*Abelmoschus esculentus*: An annual coarse herb bearing edible pods which are used as a vegetable when immature. The composition of the pods is:—

	Range of Composition.
Moisture	80.7-90.2
Protein	1.6- 4.2
Fat	.2- .4
Starch, Sugar, etc.	4.0-12.1
Fibre	1.2- 3.4
Ash	.6- 1.4
N.R.	2.8- 3.1
F.R.	20.0-32.5
F.U.	8.5-23.6
R.C.	24. -62.

Onion.—*Allium Cepa*: A perennial herb, cultivated as an annual for its fleshy bulbs which are employed for seasoning purposes.

Parsley.—*Carum Petroselinum*: A herb, native of Europe, used for garnishing dishes.

Pea.—Blackeye: *Dolichos sphaerosperma*: An annual climber who seeds are used as a vegetable.

Cow: *Vigna Catjang*: An annual, bean-like rambling vine. The pea furnishes a good human food.

Increase: Similar to Cow Pea in habit and uses.

Pigeon: *Cajanus indicus*: A perennial shrub whose seed are eaten when nearly mature. It gives a crop in 11—12 months of 3—4 cwt. per acre. The composition of the peas is:—

Moisture	10.5
Protein	22.3
Fat	2.1
Starch, Sugar, etc.	60.9
Fibre	1·2
Ash	3.0
N.R.	2.9
F.R.	29.0
F.U.	121.9
R.C.	361.

Pepper: *Capsicum annuum*: Herbaceous or shrubby annuals or perennials natives of tropical America, cultivated for their fruits which are employed principally for dressing dishes.

Pumpkin.—*Cucurbita Pepo*: An annual climber, grown for its large fruits which are employed as a vegetable. A vine yields under favourable conditions a crop in about 6 months of 2 cwt. of fruits. The composition of the fruit is:—

Moisture	88.9
Protein	.7
Fat	.3
Starch, Sugar, etc.	9.0
Fibre	.5
Ash	.6
N.R.	14.0

F.R.	30.0
F.U.	15.7
R.C.	42.

Purslane: *Portulaca oleracea*: A herb possessing succulent stems and leaves which are sometimes used in making salad. Grows wild in many parts of the colony. The composition and food value are similar to those of **Calalu.**

Rice: *Oryza sativa*: A member of the grass family; an annual cultivated for its grain, which constitutes a staple article of diet, introduced into British Guiana in 1782 during the French occupation. In 1898, only 6,500 acres of rice were under cultivation in the colony, while at the present time more than 30,000 acres are cultivted. The plant yields a crop in 4 to 5 months. In some part of British Guiana two crop are obtained annually; with proper irrigation a return per acre of 42 cwt. of padi is obtained. The average return per acre over the whole colony over large areas is 32 cwt. The varieties of rice are legion: those cultivated most commonly in the colony are Demerara Creole, Berbice Creole, No. 75. and H. 6 The husked grain is employed in many ways as food—as a cooked vegetable, in cake, bread, pudding, etc. The food values of padi and of rice are indicated in the following tables:—

PADI.

	General.	*Demerara Creole.*	*Berbice. Creole.*	*No. 75.*	*Demerara Hill Rice.*	*Wild. Indian.*
Moisture	12.6	13.6	10.3	13.1	12.3	11.9
Protein	6.1	6.5	8.4	6.6	6.5	9.8
Fat	2.0	2.2	2.9	2.3	2.6	.8
Starch, Sugar, etc,	74.1	64.9	68.6	64.0	66.2	73.3
Fibre	4.0	7.5	2.5	8.6	6.9	2.1
Ash	1.2	5.3	3.4	5.4	5.5	2.1
N.R.	13.0	10.8	9.0	10.6	11.2	7 6
F.R.	37.0	29.5	23.6	17.8	25.5	91.6
F.U.	94,8	86.6	96.9	86.3	89.4	99.8
R.C.	347	313	343	311	332	348

MILLED RICE.

	British Guiana.	*Rangoon.*	*Carolina.*	*East Indian.*		*Japan*	*Polished*
	White	*White*	*White*	*White*	*Brown*	*Brown*	
Moisture ...	11.2	14.4	12.2	12.7	12.0	11.1	12.4
Protein ...	7.8	6.9	7.8	6.9	8.0	8.5	7.5
Fat ...	.5	.5	.4	.2	2.0	1.9	.4
Starch, Sugar, &c	79.4	77.6	78.9	79.1	75.0	76.0	78.8
Fibre ...	.3	.1	.3	.3	1.0	1.0	.4
Ash ...	.8	.4	.5	.6	1.0	1.5	.5
N.R. ...	10.3	11.4	10.2	11.5	10.1	9.5	10.6
F.R. ...	159.0	155.2	197.2	395.5	38.0	40.0	197.0
F.U. ...	100·0	96.2	99.4	97.0	105.0	102.	98.5
R.C. ...	362	351	359	354	363	364	357

Sage: *Salvia officinalis*: A herb employed for flavouring.

Sago: *Metroxylon Rumphii*: A palm of medium size whose trunk yields the sago of commerce. The range of composition is:—

	Ordinary Sago.	*Pearl Sago.*
Water ...	12.81—16.8	... 12 —15
Protein ...	.2— 2.1	... ——
Fat ...	.1— .2	... ——
Starch, Sugar, etc.	77.0—82 3	... 84.9—87.8
Fibre ...	.1— 4.0	... ——
Ash ...	.6— 3 8	... .1— .2

Seaside Purslane: *Sesuvium portulacastrum*: A succulent herb, commonly found on the coastlands of the colony. The stems are used as a vegetable. The composition and food value are similar to that of Calalu.

Scarlet Runner: see Bean.

Shallot: *Allium ascalonicum*: A perennial herb grown as an annual for its fleshy bulbs which are employed for flavouring purposes in a similar manner to the onion.

Soya: see Bean.

Spanish Calalu: see Calalu.

Squash: *Cucurbita maxima*: A herbaceous climber producing fleshy fruits which are used as a vegetable.

The composition and food value are similar to those of the cucumber.

Sugar Cane : *Saccharum officinarum* : A member of the grass family cultivated for the sugar-containing sap or "juice," contained in the stems, from which the cane sugar of commerce is manufactured. The plant is grown on a large scale in the colony, nearly 60,000 acres being cultivated. More than one-thirds of the colony's population is directly engaged in the industry. Sugar and its by-products, rum, molasses and molascuit contribute 80% of the total value of the exports of British Guiana. The plant yields a return in 14 months. An average return for the colony is 1.8 tons of cane sugar per acre.

Sweet Potato: *Ipomoea Batatas*: A perennial creeper, native of tropical America, cultivated as an annual for its tuberous roots. A crop is obtained in 4 to 5 months of 2 to 4 tons of roots per acre. The plant is propagated by cutting up the tubers which produce numerous shoots, or by planting cuttings of the stem. The roots, which have a starch content of about 20% are employed as a vegetable. Composition :—

	Tuber.			*Meal.*	*Starch.*
Moisture	73.1	to	60.2	12.0	13.7
Protein	.6	,,	4.4	5.1	.8
Fat	.4	,,	.8	1.2	.1
Starch, Sugar, etc.	13.3	,,	33.8	76.9	85.3
Fibre	.6	,,	17.8	1.9	
Ash	1.1	,,	1.3	2.9	.1
N.R.	7.7	,,	23.3	15.6	101.9
F.R.	33.2	,,	54.7	64.1	853
F.U.	15.8	,,	44.8	93.7	87.7
R.C.	112	,,	135	347	354

Talipot: *Corypha umbraculifera et* spp: A tall-growing palm flowering when 25 to 35 years old. Starch is obtainable from the trunk, as in the sago palm.

Tannia: *Colocasia macrorhiza*: A perennial herb grown as an annual for its starchy tubers. A crop of 1½ to 2 tons per acre is obtainable in 9 to 12 months.

The plant is propagated by planting small tubers. The tubers, which constitute an important article of diet, have the following composition:—

Moisture	78.4
Protein	2.7
Fat	.3
Starch, Sugar, etc.	16.1
Fibre	2.0
Ash	.5
N.R.	6.2
F.R.	53.7
F.U.	23.5
R.C.	80.

Thyme: *Thymus citriodorus*: Used in the same manner as Sage.

Tomato: *Lycopersicum esculentum*: An annual coarse herb, native of South America cultivated largely, for its sub-acid fruits which are eaten cooked or uncooked. Propagated by seed which is sown in a box and transplanted to a well-drained bed. The fruits have the following composition:—

Moisture	93.4
Protein	1.0
Fat	.2
Starch, Sugar, etc.	4.0
Fibre	.8
Ash	.6
N.R.	4.5
F.R.	20.0
F.U.	7.0
R.C.	22.

Turnip: *Brassica rapa*: A perennial resembling the radish. The plant is not usually a success in the Tropics.

Water Calalu: see Calalu.

Yam: *Dioscorea alata*: A perennial climber introduced from the East, and cultivated for its edible tubers. Several varieties occur, the best of which is probably that known as "Buck Yam." The plant yields a crop of tubers, in 9 to 11 months, of $1\frac{1}{2}$ to 3 tons, which have the following composition:—

Moisture	74.0
Protein	2.0
Fat	.5
Starch, Sugar, etc.,	20.0
Fibre	2.2
Ash	1.3
N. R.	10.6
F. R.	40.0
F. U.	26.2
R. C.	73.

Yard-Long Bean: see Bean.

II.

FRUITS AND SPICES.

Abai: see African Oil Palm.

Acquero: *Astrocaryum Tucuma*: A native palm bearing yellow fruits with an oily pericarp.

African Oil Palm: *Elaeis guineensis:* A medium sized palm native of West Africa, whence it was introduced by slaves into this colony and planted in fair quantity near to the coastlands. An oil employed principally as a lubricant is extracted from the pericarp of the fruit. This oil is also used as a fat in cooking. The oil derived from the kernel is employed in the making of perfumes, etc.

Akee: *Blighia sapida*: A tree bearing bright scarlet fruits 2 to 3 inches long, said to be native of West Africa. The white inner portion of the fruits is eaten either alone or used in making a sauce.

Allspice: *Eugenia Pimenta*: The "Bay" tree of the West Indies which furnishes the allspice of commerce, consisting of the dried fruits. The produce is sometimes large. The odour and flavour of the berries, due to a volatile oil, resemble a combination of cinnamon, cloves and nutmeg, hence the name allspice. Allspice is largely used for flavouring purposes. The oil is occasionally employed as a carminative.

Almond or Seaside Almond; *Terminalia Calappa.* A tree producing oval-flattened fruits whose outer portion is edible.

Annatto. *Bixa Orellana.* A small tree bearing terminal clusters of spiny fruits containing small seeds used in colouring cheese and butter. Widely distributed, but here of no commercial importance.

Arabian Coffee. *Coffea arabica.* A native of Abyssinia, cultivated for its seeds from which the best coffee is made. The plant is grown in fair quantity in the lower reaches of the rivers of the colony, but is not so well suited to the conditions of soil, climate and labour as another variety—Liberian. The plant yields a crop in three years, when grown under favourable conditions, of 4 to 8 cwt. of dry coffee per acre.

Areca: *Areca Catechu*; A tall-growing palm, cultivated for its fruits, which possess astringent and aromatic properties. Though not grown to any large extent in the colony it is very largely employed by certain Eastern races in their native homes.

Avocada Pear; *Persea gratissima*; A medium to large sized tree bearing rounded or bottle-shaped fruits, green or purple, which are either eaten alone or used in the making of salads. The tree does not flourish on the heavy soil of the front lands but at some distance from the coast, on lighter land with a good depth of drainage, it often yields large crops. The composition of the fruit is as follows.—

Flesh, 65%; Rind, 10%; Stone, 25%. The flesh contains about 1.7% sugar, 10.5% oil, 5.7% protein, 4% fibre, and 2% ash.

Awarra: *Astrocaryum tucumoides*: A palm resembling closely the Acquero.

Balata: *Mimusops globosa*; The small, rounded fruits are gathered and eaten by native Indians in the forest. The tree is widely distributed in the colony, occurring most frequently on rising ground away from the water's edge, on the middle reaches of the rivers, but not infrequently on low land near the banks of creeks. The flowers emit an agreeable odour.

Banana: *Musa sapientum*: An annual possessing large leaves with well-developed sheaths, bearing elongated cylindrical fruits which are eaten fresh when ripe, or are sometimes dried and converted into meal or flour. Several varieties occur. The composition of the fruits of two common varieties and of the meal and flour are :—

	Chinese	*Jamaica.*	*Meal.*	*Flour.*
Moisture	67.1	75.8	12.8	10.9
Protein	5.0	1.3	1.6	.7
Fat	.2	.3	.3	.2
Starch, Sugar, etc.,	26.5	20.5	81.7	84.9
Fibre	.3	.7	.6	.7
Ash	.9	1.4	3.0	2.6
N. R.	3.5	16.3	49.1	120.0
F.R.	132.5	683.	172.3	424.5
F.U.	29.8	24.5	81.6	87.1
R.C.	131.	92.	344.	353.

Barbados Cherry: *Malpighia glabra*: A tree which is usually grown in the colony in hedges. It produces small, rounded acidulous fruits which are sometimes eaten fresh when ripe, but are more usually employed in the making of jams.

Barbados Gooseberry: *Pereskia aculeata*: A trailer bearing spines on stem and young branches, and producing very acid fruits.

Bay Tree: see Allspice.
Betel Nut: see Areca Nut.

Bilimbi: *Averrhoa Bilimbi*; A tree native of India and China, bearing on the stem and branches numerous fruits resembling small cucumbers: employed in making pickles.

Brazil Nut: *Bertholletia excelsa*; A large tree bearing hard, rounded fruits containing 18 or more nuts which are of excellent flavour. Said to be native of Guiana, but only two trees (cultivated) are known to occur in this colony.

The kernels of the seeds have the following composition:—

Water	6.40
Fat	70.16
Albuminoids	12.33
Amides	.25
Glucose	.15
Pectose	3.98
Digestible Fibre	2.08
Woody Fibre	2.08
Mineral Matter	3.34

The kernels of seeds of Suwari Nut (*Caryocar tomentosum*) have a similar composition.

Cacao: *Theobroma Cacaó.* A tree of medium size cultivated formerly by the Dutch in quantity principally on the banks of the river Berbice, bearing large fruits containing seeds—"beans"—from which, when dried and cured, the cacao and chocolate of commerce are made. There are now about 2,000 acres under cultivation in the colony. The composition of the cured bean of two varieties is;—

	Forastero Amelonado		*Forastero Angoleta*
Moisture	7.2	...	6.3
Protein	10.7	...	8.6
Fat	40.7	...	52.1
Starch, Sugar, etc. ...	6.1	...	7.3
Fibre	17.1	...	11.9
Ash	4.5	...	3.1
Alkaloids	1.6	...	1.9
Astringent Matters, Pectin and Organic Matter	12.1	...	8.8

Carambola: *Averrhoa Carambola*: A tree bearing five-cornered channelled fruits, 3 to 4 inches long, of a pleasant acid taste, used in making preserves.

Cashew: *Anacardium occidentale*: A tall shrub or tree bearing fruits consisting of a "seed" (the true fruit) at the top and a fleshy portion below. The fleshy portion is eaten fresh. The nuts, when cooked, have an excellent flavour.

Cherimoya: *Anona Cherimolia*: A small tree bearing heart-shaped sub-acid fruits of good flavour. Occurring only in gardens in the Colony.

Christmas Tree: *Pithecolobium dulce*: A medium-sized tree of Mexican origin, bearing pods which contain a white, edible pulp. It occurs in gardens in the Colony.

Chili Plum: *Spondias purpurea*: A medium-sized tree, native of Jamaica, bearing yellow fruits, one inch long, of pleasant flavour.

Cinnamon: *Laurus Cinnamomum*: A tree introduced from the East Indies but not grown in the colony to any appreciable extent. The bark constitutes the cinnamon of commerce.

Citron: *Citrus medica*: A small-sized tree bearing oblong fruits of varying size, the thick rind of which is candied.

Clove: *Caryophyllus aromaticus*: Introduced from the East Indies. The flower bud picked just before it is ready to open and dried in the sun constitutes the clove of commerce.

Coconut: *Cocos nucifera*: A tall palm bearing large, rounded fruits of which the kernel, known as "meat," is either eaten raw or exported when dry as copra. From this, oil, vegetable butter, etc., are made. The kernel is sometimes converted into meal after most of the oil has been expressed. There are 25,000 acres under cultivation in the colony. Mature trees yield 50 to 100 fruits on the average; and about 5,000 fruits are required to produce a ton of copra. The immature fruits contain a liquid which is a pleasant beverage. The composition of meat, copra and meal is:—

	Meat.	*Copra.*	*Meal.*
Moisture	39.8	3.4	11.4
Protein	3.4	5.4	19.5
Fat	46 1	73.7	15.7
Starch, Sugar, etc. ...	8.1	13.3	20.2
Fibre	1.9	3.0	27.5

	Meat.	*Copra.*	*Meal.*
Ash	.7	1.2	5.7
N.R.	36.3	36.6	3.1
F.R.	.2	.2	1.3
F.U.	132.4	211.2	108.3
R.C.	476	762	309

Coffee: see Arabian Coffee, Liberian Coffee.

Cokerite : *Maximilliana regia*: A large palm bearing clumps of numerous ovoid fruits of which the pericarp is eaten.

Custard Apple: *Anona reticulata*: A small, or medium-sized tree bearing rounded fruits about four inches in diameter, containing a yellowish-white pulp.

Date Palm: *Phoenix dactylifera*: Native of Egpyt. A few plants occur in the colony. The fruits form a staple article of diet in its native home. Although the palm fruits in some of the West Indian Islands, it rarely fruits in British Guiana.

Dunks: *Zizyphus Jujuba*: Native of India and China. A tree whose fruits, of the size of a large cherry, are borne on the branches at the basis of the leaves. The edible portion of the fruit is mealy and of acid flavour.

Fat Pork: *Chrysobalanus Icaco*: A large shrub bearing small rounded fruits of mealy consistency.

Forbidden Fruit: see Grape Fruit.

Geneps or Cheneps: *Molicocca bijuga*: A tree native of tropical America, bearing small green fruit, one inch long. The pulp is acidulous containing malic acid. A decoction of the bark of the tree is astringent and useful in cases of dysentery.

Ginger: *Zingiber officinale*: A perennial, member of the banana family, low growing, producing numerous rhizomes which when cured, constitute the ginger of commerce. A crop can be obtained, in 18 months, of about 4 tons of tubers per acre. Two varieties occur—the Chinese or common, and the Jamaica. Loose friable soil is required for their successful cultivation.

Golden Apple: *Spondias dulce*: A tall tree bearing sub-acid, yellow, rounded or oblong fruits, about two inches in diameter.

Governor's Plum: see Sidium.

Granadilla: *Passiflora quadrangularis:* A climber with square stems bearing large fruit about six inches long, and four inches or more in diameter, the pulp of which resembles the Simitoo.

Grape—Seaside: *Coccoloba uvifera*: A tree growing in its native habitat on the seashore, bearing large numbers of small reddish-purple berries of good flavour.

Grape Fruit or "Forbidden Fruit": *Citrus decumana* var. *Paradisi.* A tree resembling the Shaddock, bearing smaller, smooth rounded fruits whose pulp possesses an excellent flavour,

Grape Vine: *Vitis vinifera*: A vine bearing clusters of rounded, green or purple fruits which are either eaten fresh or employed in making wines, etc, For its successful cultivation good, rich, light soil is needed, The plant needs careful attention in regard to pruning and cleaning.

Guava. *Psidium guyava*: A loose, spreading tree of small to medium size, bearing green or yellow fruits usually the size of duck's egg; used principally in the making of preserves,

Flesh	85%
Skin	12%
Seeds	3%

Flesh contains 4.2% sugars.

Guinea Pepper. *Amomum Grana-paradisi.* A herbaceous ginger-like plant whose seeds, when freed from the husk, form a useful spice.

Hogg Plum. *Spondias lutea.* A tall tree bearing yellow sub-acid fruits of pleasant flavour,

Jak Fruit. *Artocarpus integrifolia.* A tree introduced from the Pacific Islands, bearing on the stem and lower parts of the branches, large, rough fruits, sometimes more than 20 inches long, containing seeds which resemble and are employed in a similar manner to the Bread Nut, Jamoon: *Eugenia paniculata*: A quick-growing tree, introduced from the East, bearing round-oblong fruits of the size of a marble. The fruits are eaten fresh and are also employed in making a beverage.

Java Plum: *Syzygium Jambolanum*: A large spreading tree, native of the East Indies, bearing large numbers of small purple fruits which are astringent and are used in making a preserve.

Kola: *Kola acuminata*: A medium sized tree whose seeds are used as a condiment. The tree was formerly cultivated in fair quantity on the lower reaches of the rivers.

Lakocha: *Artocarpus Lakoocha*: A tree resembling somewhat in growth the Jak fruit, bearing on its branches reddish-yellow fruits whose surface is covered with small knobs. The fruits are of pleasant, sub-acid flavour.

Lemon: *Citrus Limonum*: Similar to the Citron, but bearing smaller fruits which are useful in the preparation of beverages, dishes, etc.

Liberian Coffee: *Coffea liberica*: When allowed to grow unchecked, this plant forms a tree of medium size, bearing rounded fruits whose seeds when cured constitute one of the common kinds of commercial coffee. The lower cost of cultivation, higher yield and cheaper picking and handling of the fruit render it more suitable for cultivation in British Guiana than the Arabian or Creole coffee. The area under cultivation in Liberian Coffee in the colony is being extended. There are now 5,600 acres under cultivation in coffee in the colony. The plant commences to bear in 3 to 4 years and when mature gives a return of 7 to 20 cwt. of dried coffee per acre. The value of coffee depends on its alkaloid content. Like tea, when taken in large quantities it may injuriously affect the nerves and stomach. The alkaloids are not present in the fresh seed as such, but are produced by the breaking down of more complex bodies.

Lime: *Citrus medica* var. *acida*: A tree resembling in habit the lemon, bearing small rounded acid fruits from which "lime juice," is obtained. The juice is extensively used for cooking, flavouring, and drinking. There are 700 acres under cultivation in the colony in lime trees. The tree takes 8 years to reach maturity, but produces a crop in 3 to 4 years.

Litchi: *Nephelium Litchi*: A tree, native of China. bearing bunches of small fruits of excellent flavour. The tree is but little seen in the colony.

Locust: *Hymenoea Courbaril*: A tall tree, native of this colony, bearing pods which are filled with an edible pulp of pleasant flavour.

Loquat: *Eriobotrya japonica*: A tree, native of Japan, bearing small yellow sub-acid fruits, occuring only in Botanical Gardens.

Love Apple: see Tomato.

Malacca Apple: *Eugenia malaccensis*: A tree introduced from the East Indies, bearing pear-shaped fruits, used principally in making preserves.

Mammee Apple: *Mammea americana*: A native tree bearing large, rounded, brown fruits useful in making jams.

Mango: *Mangifera indica*: A tree of medium size, native of India, largely grown in the colony for its edible fruits. Great improvement in the quality of the fruit has been made from time to time by grafting. Many varieties occur. The composition of the fruit is as follows:—

Flesh ...	... 67—75% of the whole fruit
Stone ...	... 22—30%

The flesh contains 5.5 to 11.5% of sugars, according to the variety.

Melon—Musk: *Cucumis* Melo var. *moschata*: A creeper resembling the cucumber, bearing fruit like the European melon.

Water: *Cucumis citrullus*: Resembling the above.

Nutmeg Tree: *Myristica fragrans*: A tree, native of the East Indies, bearing yellow fruits the size of an egg. The aril present in the form of a network covering the seed, is the Mace of commerce; the seed is the Nutmeg. The plant is cultivated on the lower banks of the rivers. The yields obtained, do not equal those of the plant grown at higher altitudes in the West Indian Islands.

Orange:—Sweet: *Citrus Aurautium*: A tree resembling the lemon, whose fruits vary a good deal in the thickness of the rind and quality of the pulp. The tree is cultivated fairly extensively on the lower banks of the rivers.

Seville; *Citrus vulgaris*: A tree resembling the above, bearing large fruits with a rough rind, used in the preparation of marmalade.

Tangerine: *Citris nobilis*; Resembles the above in habit, but bears a smaller fruit of excellent flavour.

It usually takes from five to seven years after planting for these trees to commence to bear fruit, although in some cases a small crop may be obtained sooner.

Parapee or Peach Palm: *Guilielma speciosa*: A native palm growing from 60 to 80 ft. high with its stem armed with rings of spines. The fruits, which are scarlet and orange in colour, are borne in large, drooping bunches, and may attain the size of an apricot. The fleshy outer portion of the fruit is rich in starch. It is eaten usually boiled or roasted. A beverage is also prepared by fermenting it. A meal obtained from the fruit is made into cakes. The composition of the flesh is:—

Water	47.93
Oils, Fats, etc.	5.30
Albuminoids	4.06
Sucrose	2.43
Glucose	1.22
Starch	19.50
Gums, Pectose, etc.	4.43
Fibre	13.77
Ash	1.36

Papaw: *Carica Papaya*: A tree, native of tropical South America, seldom exceeding twenty feet, whose stem is composed of soft wood, bearing rounded or oblong orange-yellow fruits of various sizes and excellent flavour. The tree grows rapidly and is cultivated in the colony in fair quantity.

Flesh	65 per cent.
Rind	10 per cent.
Seed	25 per cent.

Flesh contains 5.6 per cent. sugar.

Peach or Mabola: *Diospyrus discolor*: A tree of medium size with dark green leaves, bearing rounded fruits the size of a large apple, velvety with cream-coloured flesh. Cultivated in the colony to a small extent. A native of the East.

Pineapple: *Ananassa sativa*: A biennial, with thin leaves of fibrous texture, bearing numerous short spines. The fruit produced at the end of the short stem, takes the form of a cone surmounted by a crown of small leaves. It possesses an excellent flavour and contains a highly digestive enzyme, capable of digesting 1,000 times its weight of protein in a few hours, hence its great value as a digestive. The fruit contains 85.8 per cent. water, 11.5 per cent. sugars, .4 ash, 1.5 per cent. fibre. The range of variation in the kinds of sugars is, fruit sugar, 1.7 to 9.7 per cent; cane sugar, 3 to 10.5 per cent.

Pimento: see Allspice.

Plantain: *Musa paradisiaca*: A plant with a herbaceous stem resembling somewhat closely the banana. The fruits, which are borne on a spike, are 9 to 10 inches long and about 1½ inches in diameter. They are used in the green state and also when ripe. They constitute a staple article of diet of the inhabitants of the colony. Meal and starch are also made from the fruits. The compositions of the unripe and ripe fruits, and of plantain flour and starch, are :—

	Unripe	*Ripe*	*Flour*	*Starch*
Moisture ...	62.8	75.0	11.8	14.9
Protein ...	1.6	1.3	3.7	.2
Fat ...	.4	.3	1.0	.4
Starch, Sugar, etc.	34.0	18.1	80.7	84.2
Fibre ...	.4	4.7	.9	.1
Ash ...	.8	.6	1.9	.2

N.R.	...	22.2	14.4	22.2	425.0
F.R.	...	85.0	60.3	80.7	210.5
F.U.	...	39.	22.0	92.5	85.5
R.C.	...	150	82.3	355	350

Plum rose : *Eugenia vulgaris* : A tree native of the East naturalised throughout the West Indies, bearing pear-shaped, greenish fruits, 1½ inches in diameter, of firm texture and somewhat sickly flavour.

Pomegranate : *Punica granatum* : A small tree, said to be native of Southern Europe, bearing fruits the size of a large apple, containing numerous seeds, each surrounded by a small quantity of fleshy pulp.

Saman : *Pithecolobium Saman* : A quick-growing expansive tree native of the East bearing pods which have the following composition :—

Moisture	...	...	...	63.0
Protein	...	...	...	3.3
Fat	...	...	...	.4
Starch, Sugar, etc.	...	...	...	30.9
Fibre	...	...	...	1.5
Ash	...	...	...	.9
N.R.	...	...	...	9.7
F.R.	...	...	...	75.2
F.U.	...	...	...	40.
R.C.	...	...	...	144

Sapodilla : *Achras Sapota* : A tree, cultivated in many parts of the Tropics, bearing fruits of a brown colour which vary in size with different varieties. The fruits possess a delicate flavour and rank among the best in the Tropics.

Sea Grape : see Grape.

Seville Orange : see Orange.

Shaddock : *Citrus decumana*: A tree belonging to the lemon, "Forbidden Fruit," and Citron class, bearing large fruits with a thick rind. The pulp, of sub-acid flavour, is eaten. The rind is used in making a preserve.

Sidium : *Flacourtia Ramonthii* : A tree producing large quantities of fruit of the size of a large cherry, of a purplish black colour with firm flesh, eaten when ripe or used in making a preserve. Grown in the colony in fair quantity.

Simitoo ; *Passiflora laurifolia* : A creeper with variegated flowers bearing rounded yellow fruits whose pulp possesses a pleasant flavour.

Soursop : *Anona muricata* : A small tree, resembling the Custard Apple, bearing large fruits whose pulp possesses a pleasant sub-acid flavour.

Sorrel : *Hibiscus Sabdariffa* : A coarse herb resembling the Okra. The fleshy persistent calyx of the fruit, after fermentation with water, yields a beverage.

Star Apple : *Chrysophyllum Cainito* : A medium-sized tree with ornamental foliage, native of America, bearing rounded green or deep purple fruits from 2 to 4 inches in diameter. The pulp of the fruit is edible.

Sugar Apple : *Anona squamosa* : A tree resembling the Custard Apple and Soursop, bearing green or yellowish green rounded fruits about three inches in diameter, containing a whitish pulp of delicate flavour.

Surinam Cherry : *Eugenia Michelii* : A small tree bearing rounded fruits the size of a large cherry, marked with vertical furrows : of good flavour when ripe.

Suwari Nut : *Caryocar tomentosum* : A large forest tree bearing large fruits each of which contains two, three or four seeds, whose kernels rank among the best of edible nuts. The composition of the kernels is similar to the Brazil Nut. We have, however, found Suwari Nuts on analysis to be more oleaginous than the Brazil Nut.

Tamarind : *Tamarindus indica* : A tree of medium to large size, said to be native of Tropical Asia and Africa, bearing a pod with acid pulp which makes an excellent preserve and yields a syrup from which a pleasant cooling beverage is made. Grown in towns and villages.

Tangarine: see Orange.

Tonka Bean; *Dipteryx odorata*: A large tree, native of the colony which yields the fragrant seed known as Tonka or Tonquin, used for scenting snuff. An extract is obtained from the seed, which is employed in perfumery. The pulverised seed is used in making sachets, and is also employed in flavouring appetisers or "bitters." The plant grows readily from seed. A tree will yield about 20 to 30 gallons of seeds. The odour of the seed resembles that of new-mown hay, and is due to the presence of coumarine.

Tooroo: *Oenocarpus Batawa*: A tall native palm, bearing bunches of small chocolate-coloured fruits. The fleshy outer portion of the fruit is used in making a beverage resembling chocolate.

Vanilla: *Vanilla planifolia*; A climbing orchid bearing thin pods which are extensively used for flavouring purposes. This and other species are native of the forests of the colony. The pods are used by the native Indians, but there is no recognised industry in the colony.

The following table prepared by us in conjunction with Mr. R. Ward for the Government in August, 1914 shows the principal kinds of vegetable food-stuffs which are locally grown, the time usually taken from sowing or planting to reaping, and the average crops which they may be expected to yield per acre under the conditions prevalent on the front lands of the colony. The yields given in the table are for crops grown *per se*; when they are raised in mixed cultivation their yields will be almost proportionate to the area each kind occupies, although in some cases the yields per actual area occupied may be somewhat greater in mixed cultivation than where crops are grown separately. On the other hand it is certain that the yields of many others will be more than proportionately reduced.

	Months.	*Yields per Acre.*
Sweet Potatos	4— 5	2 to 4 tons
Cassava (sweet)	6— 8	4 to 8 tons
Arrowroot	9—11	7 to 14 cwt. starch
Indian Corn or Maize	4	16 to 25 bushels
Guinea Corn	3— 5	20 to 50 bushels
Yams	9—11	1½ to 3 tons
Tannias	9—12	½ to 2 tons
Eddoes Chinese	5— 6	1½ to 2 tons
Ground Nuts	4— 5	½ to ¾ ton
Various beans	3— 6	Not known
Pea trees	11—12	3 to 4 cwt.
Papaws	10—12	50 lbs. per tree
Pumpkins, etc.	6	2 cwt. per vine may be obtained under favourable conditions.

In 1903 after the occurrence of a severe hurricane in Jamaica the Hon. H. H. Cousins, M.A., F.C.S., Director of Agriculture in that colony, compiled the following very instructive table, showing the proportion of nitrogenous, flesh-forming or proteid content in lbs. per ton of important varieties of foodstuffs, the fuel value in British Units, together with statements of average labourers' requirements of each sort of food in pounds per diem, firstly to conserve his bodily condition by meeting its nitrogenous requirements, and secondly to meet its requirements in fats and carbohydrates when engaged in heavy labour. The well balanced nature of such tropical foodstuffs, as sweet potatos, rice and corn meal, where the quantities required for conserving the bodily condition and for meeting working requirements are approximately similar, is very clearly indicated; whilst the lack of balance in dried banana, breadfruit, mango pulp, coconuts, and molasses, each of which supplies an excess of carbohydrates, and in beans, peas, salt fish, and fresh fish, where the proteid content is very high in relation to the fats and carbohydrates, is noticeable. The advisability of using relatively small proportions of these foods containing a high proportion of protein in conjunction with larger quantities of those rich in fats and carbohydrates, is clearly indicated by the figures given by Mr. Cousins.

	Flesh Formers: lbs. per ton.	*Fuel Value: units per lb.*	*Labourers' Food Requirements: lbs. per diem.*	
			To conserve bodily condition.	*To meet working requirements.*
Sweet Potato	42	440	9	7¾
Irish Potato	36	295	10	12½
Dried Banana	32	1,456	12	2⅓
Bread Fruit	47	823	8	4
Mango Pulp No. 11	8	318	47	10¾
Coconut	58	2,500	6½	1⅓
Bakers' Bread	180	1,300	2	2⅜
Rice	160	1,620	2⅓	2
Cornmeal	184	1,645	2	2
Beans (shelled)	142	540	2½	6¼
Peas (dried)	428	1,505	14 ozs.	2¼
Salt Fish	320	325	1¼	10½
Fish, fresh	200	370	1⅞	9¼
Pork, fresh	260	1,300	1⅛	2⅜
Molasses	nil	1,225	useless	2¾
Cow's Milk	66	310	½ gal	1 gal.

While we have been dealing in the above with foodstuffs from the aspect of their compositions, the importance of vitamines cannot be overlooked. These bodies are present in such foodstuffs as brown rice, maize, guinea corn, wheat, sweet potatoes, bananas and other fresh fruits, butter and milk. Hot-air-dried foodstuffs such as cassava and banana meals and flours as well as white and polished rice are deficient in vitamines; the almost complete absence of vitamines from purely starchy foods, and from both animal and vegetable fats when separated in a state of purity from the other constituents of the products in which they are contained or, as in the case of ghee, when prepared at unduly high temperatures, is of importance. At the present it is not feasible to determine the relative proportions of these bodies by chemical analysis; but consideration must be given to their presence or absence in the drawing-up of any scheme for nutrition in tropical as well as in temperate climates.

THE PREPARTION AND COOKING OF LOCALLY GROWN VEGETABLE FOODSTUFFS.

Mrs. J. F. Waby.

There is a very old saying which tells us that "It takes a very good cook to boil a potato, as though easy to boil it's easy to spoil." The same may be said of all vegetables; they are not difficult to cook, but they are very easily spoiled. If not perhaps actually spoiled, they are not what they ought to be either in appearance, taste or adaptability. In all books on Domestic Economy, Cookery, etc., great emphasis is laid on the need of great care in cooking and serving vegetables.

British Guiana has been described by an old resident as "a land of sodden vegetables," and not without reason; yet the blame does not lie with the vegetables, but with the lack of care and attention given to their preparation and cooking. Sometimes perhaps, it is due to lack of knowledge, particularly in the case of newcomers to the colony. The announcement of 'No potatoes to-day" so often seen in war time in shops overseas should cause no alarm in British Guiana; we have so many good and nourishing substitutes. Few people who have eaten yams properly cooked carefully crushed and seasoned, or have enjoyed cassava boiled, roasted or fried, would regret potatoes as they often appear on our tables. Old bush travellers have often said that a roasted plantain or a bit of roasted cassava is far better with morning tea or coffee than bread or crackers.

RULES TO BE OBSERVED.

The most important rules to be observed in cooking vegetables are: they must be put into *boiling* salted water and kept at boiling point; takon up as soon as done, and *all* the water drained from them. If they are to be kept hot, a clean cloth should be folded over them to absorb the steam; if left in the water even a few minutes after they are done they will become sodden and tasteless. The only exceptions to the rule of boiling water are dried vegetables.

GREEN VEGETABLES.

In this as in all Tropical lands, green vegetables soon lose their crispness and freshness. They should—if possible as soon as gathered or purchased—be covered with a cloth wrung out of clean cold water. In the case of vegetables with roots or stalks—such as cabbage, lettuce and the various kinds of calalu—the roots or stalks should be put in water and the leaves covered with a wet cloth: green shalots, parsley and other seasonings keep fresh a long time if kept in a damp cloth and put in as cool a place as possible.

SPECIFIC INSTRUCTIONS.

French beans and green vegetables of all kinds, if limp and flabby, should be laid in a bowl of salted water for half-an-hour before cutting. Of all local green vegetables the various kinds of calalu may be considered the best—"Indian Kale" being quite as good as spinach if cooked in the same way.

Indian Kale.—Strip the leaves from the stalks: if the mid-rib of the leaf is tough, cut it out, wash in one or two waters to remove dust, etc., put into a saucepan with as little water as possible (just enough to prevent burning,) press down the leaves that all may be cooked alike; and when tender strain and press through a colander. Chop fine, add a little butter and pepper and return to pot to heat again, stirring carefully. Eddoe leaves—*i.e.*, "Water Calalu"—"Climbing Calalu" and "Caterpillar Calalu" may all be cooked in the same way: if served with gravy, the butter may be omitted.

Ochroes—The young pods should be topped and tailed, put into boiling salted water, drained as soon as tender, and a little lime juice and black pepper put over them.

French Beans—locally called "Sinabones"—should be topped, tailed and the strings cut away thinly, or stripped from the sides, cut in strips, put into boiling salted water, and boiled for 20 minutes; the water must *all* be poured off as soon as they are done or they become sodden and tasteless. "Goa" Beans may be cooked in the same way, but take about 30 minutes. They should be cut into short lengths. They are very like young cabbage in taste and should have a little black pepper added and, if liked, a little lime juice.

"*Sword*" *Beans*, only recently recognised as a valuable food product, are very good used as string beans if the pods are picked young, when about 4 to 5 inches in length. Cooked like French Beans, it is better to cut them into thin strips.

Some of the lately imported Bonavist Beans, notably the "Park Runner" and the broad, flat, white waxen beans are very delicate when cooked like French Beans.

The beans or seeds of the Sword Bean are covered with a tense, white skin, and unless they are used when only half-grown it is better to remove it. Shell the beans and put them into boiling salted water; when done, take them up and slip the beans out of the outer skin (as "Almonds" are blanched), return them to the saucepan and either add a little milk or make a little white sauce if butter is available. They are excellent warmed in milk with black pepper added to taste. They are very mealy and burn if not watched and stirred in the milk.

Nearly all the Bonavist beans are good, shelled and boiled as side dishes, or in soup. The round full-podded white ones are the best; they resemble English green peas in appearance and—if cooked in the same way—in taste. They should be shelled, washed, put into boiling salted water and boiled till tender. A bit of mint boiled with them improves colour and flavour. They take from 20 to 30 minutes to cook.

Butter Beans should be cooked in the same way omitting the mint.

The *Purple Bonavist* is less delicate, but is a very excellent bean and should be used in the same way, though taking more time to soften.

Black-eye Beans when young are also good, but when older serve better for soup.

Pigeon Peas—the local "Green Peas"—are much appreciated when young and tender. They may, like all the Bonavists and the "Black-eyes," be used with equally good results as side dishes, cooked with rice, or used in various soups.

Boulanger or "Egg plant" is usually stuffed, but may be used plainly boiled, or after boiling cut in slices and fried. When served stuffed (the large young ones are best, "Black Beauties") they must be split about an inch from the bottom and boiled in salted water, when tender cut them in half take out the pulp and mix with a little minced meat (ham and beef are best) a little butter or margarine, black pepper and chopped shalots, fill the skins with this, sprinkle with breadcrumbs and bake.

Pumpkins, Squashes, Cucumbers, Chrystophines, the young fruits of the Ninewha vine, and the yonng fruits of the Papaw tree may all be considered as green vegetable. They may all be prepared and cooked in the same way, *viz*: peeled, cut into pieces, put into boiling salted water, boiled till tender, taken out of the water at once and served in pieces or mash with a little black pepper and margarine or sauce. When margarine is used for vegetables it must be melted first; it does not dissolve as readily as butter.

An excellent sauce for beans, peas, or any vegetable may be made as follows:—cut a small onion and a tomato in slices fry till brown with a morsel of fat pork, add sone chopped seasoning or any herb preferred, pepper, salt and a little margarine; add required quantity of water boil together for a few minutes, thicken with a little rice flour or cassava meal.. This may be strained if desired, but is good either way to add savouriness to vegetables.

GROUND PROVISIONS.

Of all our ground provisions the yam is the most useful. The varieties of yam "are legion," and the ways of cooking and using it many.

Boiling Yams:—Peel and wash a yam, put it into boiling salted water, boil till tender, take it out as soon as it is done, crush it lightly, or serve cut in slices if large; if small, whole. Yams vary so much that a definite time cannot be given but, 30 to 40 minutes is the average, unless they are very small.

Roasted yams are excellent. Mrs. J. R. Bovell, of Barbados, gives the following direction for roasting yams: "Lay a yam before the grates of the stove or in the oven, turning it occasionally till cooked scrape off the outer skin, cut into pieces or mash with butter and serve hot"

Boiled yam cut into chips and fried is very good. Cold yam may be used in making bakes, fritters, etc (see "Puddings.")

Boiled "Buck" yam mashed with milk and a little salt, or with a little butter is good food for young children.

Sweet Potatos:—Mrs. J. R. Bovell says "Sweet Potatos should be boiled in their jackets.' When cooked, peel and cut into slices before serving. Cold sweet potatos "may be cut and fried like cold yam."

Roasted Sweet Potatos—"Same as for yams."

Broiled Sweet Potatos—"Potatos to be half boiled, the skin removed, put into the oven or before the fire till they are nice brown colour."

Sweet Cassava is good either roasted or boiled. To roast, lay a stick of cassava in the ashpan, turning it occasionally. When done, scrape off the outer skin, burst it a little to let the steam escape and roll in a clean cloth to keep hot.

Boiled Cassava. Peel the cassava, cut into pieces 4 or 5 inches long; if very thick, split them. Put into boiling salted water, boil till tender (from 10 to 20 minutes, according to size) take up at once, let steam evaporate or it will be sticky and sodden instead of being dry and floury.

Cold cassava sprinkled with salt and pepper and fried is very good.

Any cassava put away for using in bakes, pie-crust puddings, should be flaked free of lumps with a fork while hot: it then keeps drier and is more easily worked up.

Eddoes and Tannias are more generally used for thickening soups, but they are good boiled in salted water, mashed while hot,and sprinked with black pepper.

White Tannia mashed free from lumps and mixed with milk or butter is very good for children.

Plantains have been called "the staple food" of the colony, so general is their use.

Green plantains are usually boiled with salt fish: a slice of pork and one of salt beef is sometimes added, or the pork is melted and the fat used with the plantains.

To make "Foo-Foo or pounded plantain they are boiled alone without salt. When done they must be taken out of the water and left to cool. They must be pounded in a wooden mortar with a "foo-foo stick": it is necessary to dip the pestle in water occasionally to prevent sticking. The paste must be smooth and rather soft. With a spoon dipped in cold water remove the "foo-foo" from the morter, flatten to shape and serve with soup.

Yellow plantains, *i.e.*, ripe but not soft, are boiled and served as an ordinary vegetable. Taking off the ends and boiling them in their skins, keeps them a better colour. The skins slip off easily.

Fully ripe plantains are cut into slices and fried.

Green plantains, cut into thin slices and dried in the sun, are ground and yield plantains flour, or conquintay flour.

Green Corn. The pods for boiling must be only just full, and not at all hard. Strip the husks off, leaving the inner one which draw down so that the silk may be removed, then tie the inner husks round the cob, put the prepared cobs in boiling water with plenty of salt, boil till tender, take up and drain, put a little butter on and serve hot.

Or the corn may be removed from the cob with a sharp knife and boiled: when finished it may be served, with only a little black pepper, but is better with a sauce or with butter. The cobs for roasting should be stripped. If the fire is strong they may be roasted in the ashpit, but a clear coal fire is best, turning them that they may be done all round.

Breadfruit is a valuable food product, but in itself is rather insipid. If boiled in soup, stew, or with other vegetables it must be peeled and the core removed. It takes very little time to become soft. When boiled as a plain, table vegetable bread-fruit should not be peeled, but cut into quarters and put into boiling, well-salted water, 15 or 20 minutes, according to size, taken up at once laid on the "peel" side till the steam has gone then peeled, the core removed, cut into slices or mashed with black pepper. Boiled in this way and put away till cold, then peeled, cored and cut into rather thick slices sprinkled with pepper and fried in "crisco," lard or dripping, is the most tasty way of using breadfruit.

Breadfruit intended for cakes, etc., should not be crushed until wanted for use.

VEGETABLE SOUP.

Although our local vegetables are at their best when cooked in soups—that is, none of the good in them is washed—they do require the addition of fat in some form; strictly "vegetarian," they must be enriched with milk or butter. For ordinary use it is better to use a little salt or fresh meat.

The most suitable vegetables for soups are Tannias, Eddoes, Cassava, Pumpkins, Peas, Beans, Ochroes, and Calalu. Each and all are good, but they may be improved and seasoned with green "seasoning," a bunch of which contains a bit of green celery leaf, a spray of marjoram, a leaf of coarse thyme and a few green 'shalots or onion, garlic, tomatoes, (red pepper if liked), and black pepper and salt. To make them really nutritious, a little beef essence or good meat stock is necessary. But in any time of stress, especially in "war time," we cannot always get what we like, and must perforce like what we can get. The economical value of soup as an article of food is that meat rejected from joints, chops, etc., locally called "soup meat," is cheaper. Bones, (fresh or already cooked), scraps of cooked meat salt or fresh fish (free from bones) may all be used as a basis. Bones that have been roasted or fried in cooking, give soup a good colour and flavour.

Whether the meat available be much or little, if it is to be eaten with the soup it should be cut into pieces, put into cold water without salt, brought slowly to boiling point, all scum removed as it rises and boiled till tender, when vegetables and seasoning should be added. When the vegetables are done, they should be taken out, mashed and returned to the soup with salt and black pepper to taste.

When meat and vegetables are to be used separately, the meat must be put into nearly boiling water without salt, brought to boiling point and allowed to boil 2 or 3 minutes till the scum rises. When this is removed the meat must be cooked slowly till tender, when salt may be added. Only sufficient time must be given to the vegetables to cook them without mashing. Onions or any seasoning to remain in the soup should be cut small. A few pieces of green papaw boiled with the meat, help to make it tender, and with pieces of boiled pumpkin, make a nice garnishing for the meat.

When all are done, the meat and vegetables should be taken out and the soup thickened with plantain or cassava flour—1 tablesponful to each pint of soup is a good average. The flour must be mixed smoothly with cold water, poured slowly into the boiling soup and boiled for a few minutes, stirred to prevent burning and salt and black pepper added to taste. Cornmeal may be used for thickening but is better made into dumplings, boiled separately and dropped into the soup.

Soup made from beans or peas is very nutritious; for weak digestion the peas should be pulped from their skin and returned to the soup, but for general use this is not necessary. If dried peas or beans are used for soup, they must be well soaked in cold water, put into fresh cold water, brought slowly to the boil, and boiled till tender.

All calalus contain a great deal of water, and it is advisable to boil them separately, or allow for the water in them. Ochroes should be sliced. Old time folks say, "soup with ochroes and calalu in should never be stirred with an iron spoon."

For those who like them a few shrimps, picked and scalded, improve most soups.

White tannias boiled in as little water as possible, mashed in the same water, milk added to make it creamy, with a very little pepper and salt and a small bit of butter (margarine is not good in this)is a delicate and nutritious soup for young children.

CURRIES.

Curries, if carefully made and served with a wall or border of well boiled rice, are appetizing and economical dishes, as they adapt themselves to any standard of cooking. They may be simple, or elaborate as circumstances permit.

Cold meat of any kind, fish, some vegetables, such as boulangers, cucumbers, and the smaller kinds of squash, make excellent curries. Eggs, boiled hard and cut into slices or quarters, as a dish by themselves or to help out a scarcity of meat, shrimps scalded and picked, salt fish cleaned and boiled, are all good.

Fish should be freed from skin and bone, which may be well boiled, the water strained and used instead of plain water for fish curries, as it is very gelatinous.

Any stock that can be made from meat bones or scraps is much better than plain water and, of course, makes the curry richer.

To make a good Curry:—

Slice 2 or 3 onions, fry them to a good brown, taking care that they do not burn, cut meat or fowl available, fry it with the onions, put all into a stewpan with a clove of garlic, and 1 tablespoonful of curry powder, cover it with water and let it stew gently till tender, mix a full teaspoonful of cassava, rice, sweet potato, or plantain flour (either will answer) with a little milk, a bit of butter, and some salt into a smooth paste and stir gently into the lot, and let all boil together.

A little lime juice is an improvement, but it must not be *boiled*— put it in when all is finished

A simple way of making curry sauce for anything already cooked is to brown the onions, adding water (or stock) as required, mix 1 tablespoonful of curry powder, a teaspoonful of thickening flour, salt, a little butter, gravy or water, put into the pan with the browned onions and stir well till smooth, add cold meat, etc., and let all cook very slowly till heated through.

"PEPPER POT *i.e.*," "BUCK POT."

A "Buck pot" with cover is used for this old time dish—which like curries, may be made with the best of everything, or when "needs must" with simpler ingredients.

The basis of "Pepper Pot" is usually fresh fat pork, but it is less rich and much more nutritious when made with cow-heel, shin of beef, or pig's head and trotters. The meat must be cut up and boiled with a slice of uncooked salt-beef. When half done add 3 or 4 tablespoons of good, thick cassareep, 1 dessert spoonful of brown sugar, a few peppers, and salt to taste. It must boil till the meat is quite tender. Pepper-pot must be warmed every day to prevent it turning sour. When adding fresh meat, either cook it till tender separately or remove the already cooked meat until the fresh meat is well done, put back the removed meat and boil again. Cold meat may be added before boiling.

Irish Stew is a very economical dish in which a very little meat, fresh or cooked, will go a long way. If made of fresh meat, "soup meat" is excellent; the meat must be put into cold water without salt, brought to boil, any scum removed, and slowly stewed till nearly done, when the vegetables and seasoning may be put in, with pepper and salt, and all cooked together. If it is necessary to add more water, it should be hot. Cassava, yam, or sweet potatoes are all good in "Irish Stew."

If Irish Stew be made from cold meat, the vegetables should be boiled in only sufficient water to make the stew thick and good—not watery. The seasoning must boil with them and the meat be added when the vegetables are nearly done. Pepper and salt to taste. Keep *stewing—not* boiling—or the meat will harden.

MEAT PIE.

Yam, cassava, sweet potatoes, eddoes or tannias, may be used for the "crust" of this pie. The boiled and crushed vegetable must be mixed with a little margarine or dripping; pepper and salt; a deep pie dish should be lined thickly with it, and the meat stewed with onions or shalots and a bit of fat pork (a goodly supply of gravy being made with it). A layer of meat is put in, then another of vegetables, more meat and all the gravy; and a thick cover of vegetable added and a bit or two of butter or dripping. Bake a light brown.

An excellent "crust" for meat pie may be made of boiled and crushed cassava and a little margarine or other fat and a few spoonfuls of cassava flour. Sift half a teaspoonful of baking powder and a little salt with the cassava flour, add to the cassava and knead all together till stiff enough to roll. If the cassava is dry a little water may be necessary, but must be sparingly used, or the paste will be sticky. Sprinkle flour on a board and roll the paste to the thickness desired. The pie dish may be lined with it, or if the meat is sufficient to fill the dish, only the cover need be made of the paste. Make a hole in the centre of the pie to let the steam escape. Bake a good brown.

Fish—free from bone and nicely seasoned—may be used for either of these pies.

RISSOLES, PLAIN AND SAVOURY.

Plain rissoles may be made from yam, sweet potato, or cassava.

Boil and mash the vegetable; add pepper and salt and parsley chopped (if liked); shape into rissoles; dip in beaten egg; roll in bread crumbs, and fry.

Rissoles are the most tasty, though not the most economical way of using scraps of cold meat or fish.

Mince or chop finely any cold meat or fish with seasoning, pepper and salt, mix with vegetables prepared as for plain rissoles, moisten with a little milk, or a beaten egg, roll in bread crumbs or cassava flour, and fry.

Meat or fish cakes are made in the same way, but shaped into cakes and plainly fried.

CEREALS.

Rice, well boiled, is the basis of very many savory and sweet dishes, besides being in itself one of the best of our locally grown foodstuffs. In cooking, care must be taken that it is throughly boiled, a point sometimes overlooked in the desire to have it "grainy." Nothing is more indigestible than half-cooked rice.

A very up-to-date cookery book gives the following recipe and calls it.

" *A perfect way of cooking rice*:—

" Put one cup of thoroughly washed rice into 5 cups of boiling water, cook from 15 to 20 minutes in a covered saucepan then set the saucepan *uncovered* in a warm place till all the water is evaporated. Rice should not be stirred, only shaken."

The most satisfactory way of cooking rice as a breakfast dish is as the well known "rice and peas." For this almost any kind of peas or beans may be used, green or dried; the dried variety must, of course, be well soaked previously.

To a pint of peas, allow a pint of well washed rice a pinch of soda if the peas are hard, and only water enough to cook the rice. When the peas are soft, add rice, an onion chopped, and a bit of salt pork and beef cut up. Salt fish may be used, or scalded and picked shrimps. Boil till all is well done and the rice rather dry.

Cold boiled rice may be used for puddings, rissoles, thickening soups, or in sweetened and flavoured milk as "rice milk."

Rice cooked with a young chicken and a small piece of fat pork, an onion or green shalots, makes a very dainty dish. Or an old fowl may be well stewed with seasonings in plenty of gravy and rice enough to thicken the gravy used.

Rice Kedgeree is made by boiling and seasoning rice, adding fish already cooked, boned and skinned, or a tin of salmon, and pepper and salt to taste. A little milk is necessary if dry fish be used, but the oil of the salmon is sufficient.

Rice flour is invaluable in nursery or sickroom, as well as in making many dainty sweet dishes for table; used in the proportion of half and half it mixes well with wheat flour in pastry, etc. (see "Cakes.")

For blanc-mange and custards, rice-flour should supercede all imported "corn starch," "custard powder," etc, (see "Puddings.")

The "Indian corn meal" or maize flour should be far more generally used than it is, being perhaps, the most satisfying or all meals or flours, excepting oatmeal, for which it is an excellent substitute.

"The nutritive qualities of maize are considerable." As "stirabout" or "porridge" it is plainly boiled, in salted water, till thick, and eaten with milk, sugar, or molasses.

Cold boiled maize can be cut into slices and fried. It makes good cookies. (See "Cakes.")

The flour of guinea corn or millet is used in the same way: it is finer and less rough in taste.

Banana flour, locally called "Conquintay" flour, makes delicious gruel (*i.e.*, "pap") and pudding: and is excellent used for dumplings in soup or with stews.

Plantain flour is a good substitute for wheat flour, for thickening gravies and soups or for making thick sauces for haricot beans, or indeed any kind of beans.

STARCHES.

The best and most well-known of those is arrowroot.

Arrowroot is a pure starch, invaluable in the sick room, and for infants if blended with milk; or in convalescence with wine or meat essence. It is used for blanc-mange, custards, and buscuits. (See "Cakes.")

Cassava starch has many uses. Though not quite as delicate as arrow-root, it may be used in the same way. Mixed with equal proportions of wheat flour it is excellent in cakes, etc.

Sweeet potato flour is very good used for thickening soups, stews, gravies or sauces. It can also be used like rice flour in cakes, etc.

For making arrow-root, cassava starch, or "tous-les-mois " into nourishment for the sick, 1 tablespoonful should be mixed smoothly with part of a pint of milk (flavoured or not as desired); the rest of the milk boiled and poured slowly over the mixed starch, stirred and returned to the saucepan; boiled and stirred 5 or 6 minutes and sweetened to taste.

Banana and plaintain flour or starch can be prepared in the same way, but should be boiled quite 10 minutes after mixing

Breadfruit, sliced, dried and pounded makes a very fine flour, which may be used for custards, puddings, gruel or for thickening sauces.

PASTRY.

Meat pies have already been dealt with.

Pastry for an ordinary Meat Pie:—If equal parts of rice flour and wheat flour are used the pastry, though light, is not flaky. The addition of baking powder —1 teaspoonful to 1 lb. of mixed flour—makes it lighter, but it dries more quickly. A good short crust for either meat pies or fruit tarts may be made as follows:—Half a pound each of wheat and rice flour (or cassava flour), 1 salt-spoonful salt: sift together lightly; ½ lb. lard, " crisco," or "cottolene" (weight for weight crisco is best) rub the crisco into the flour with the fingers as lightly as possible, make a well in the centre and pour in nearly ½ pint of water; mix all together and roll out on a thinly floured board, fold over and roll again. If time allow, it is best to roll part of the crisco (or lard) in first. Rub the pastry and put away for half an hour; roll again and put on bits of crisco, sifting a little flour over. This may be done 3 or 4 times, the pastry being kept in a cool place in the intervals of rolling.

A good crust for Meat or Fish Pie—Take boiled cassava, finely mashed, wheat flour, a little lard or dripping and milk. Mix the flour and mashed together with a little salt, rub in the lard, mix with the milk, roll out and line the edges of the pie dish fill the dish with meat or fish, cover with the crust and bake.

PUDDINGS.

Rice Pudding; One cup boiled rice, 1 egg, ½ pint milk a bit of cinnamon or lime peel, sugar to taste. Put the flavouring into the milk to soak a little while before using. Beat egg and milk together, add sugar, pour over the rice and bake.

Cold boiled cassava, nicely flaked or crushed may be used in the same way; so may cold sweet potatos, but great care must be taken to avoid lumps.

Breadfruit pudding is delicious, but requires more flavouring for which grated nutmeg is best. It is crushed and used in the same way as cassava or sweet potatos. If desired, a few currants may be mixed in either pudding or a layer of jam or jelly may be put in.

Blanc-mange:– 1 large tablespoonful of rice or cassava flour (rice is the most delicate), ½ pint of milk, 1 flat tablespoonful of sugar, the thin peel of a lime or a bit of cinnamon. Soak the spice or peel a short time before boiling; mix the rice flour with a little of the milk while cold; boil the rest, and when boiling pour on the mixed flour, slowly stirring it well; put back in the saucepan and boil for 5 or 6 minutes, stirring it to prevent burning; add the sugar, take out the peel or spice and put into a mould or basin to cool. The same mixture with eggs and milk in proportion, poured into a pudding dish and baked, makes a delightful pudding. A little grated nutmeg and a bit or two of butter is an improvement, but not necessary.

Cold corn meal porridge is good if beaten with sugar, grated spice and milk, and eggs, if available: or corn meal may be boiled with milk, spice and sugar. Both, if baked slowly, are good and satisfying puddings.

Sweet potato starch and guinea-corn meal make good puddings, or may be used to thicken custards either baked or boiled.

Custard: Take a pint of milk, 3 or 4 eggs, sugar, spice; boil the milk and pour on the eggs, after well beating them, mix one teaspoonful of rice, or other thickening with a little cold milk, stir slowly into the boiling custard, taking care that it does not curdle; if for baking, the oven must not be over hot and the custard must be taken out as soon as coloured.

BAKES.

Bakes are good, made of any of the local flours, and take less fat for frying then pancakes or fritters.

Bakes (cold boiled cassava):—4 table-spoonfuls mashed cassava; sugar and spice to taste, and a spoonful of milk for moistering. A dust of flour helps in shaping them. Fry in boiling dripping or other fat. These bakes are good, satisfying and economical, as they take little fat for frying; if given to children with morning tea instead of bread, or crackers, the results would be better. Of course, if eggs are available they are an improvement. Cold yams, sweet potatoes, or even eddoes can be used, but are not so light as cassava.

FRITTERS.

Light fritters may be made of mashed pumpkins, cassava, yam or bread-fruit: the mashed vegetable must be mixed into a batter with flour, eggs and milk. When well mixed, drop a small cupful at a time into boiling lard, fry them to a light brown on both sides, sift sugar over and serve with a cut lime. Fritters, though nice, are not cheap, as they absord so much fat.

"PONE."

"Pone" is made from raw cassava, sweet potatoes, or corn meal, "Cassava Pone."—Grate cassava (raw), add grated coconut, sugar, melted butter, melted lard, a little grated nutmeg, black pepper and powdered cinnamon, some currants (washed and picked), a small red pepper (bruised); well grease a pan; pack the mixture in and bake.

Add grated pumpkins to "corn-meal pone": other ingredients, the same.

CAKES.

Rock Cakes or Buns may be made of equal parts of wheat and rice or cassava flour. For 24 cakes:—½ lb. wheat flour, ½ lb. rice flour, a small teaspoonful bicarbonate of soda, a pinch of salt, ¼ lb. crisco or margarine, ¼ lb. yellow sugar, a few currants of sultanas or a few drops of essence, 1 egg and nearly ½ pint milk. Sift flour, soda, and salt together, rub in crisco add sugar and currants, mix well, beat egg and milk together, put in essence (if used), stir all together and make into rock cakes; put on greased tins and bake in a moderate oven about 30 minutes. If the oven is too hot they rise too soon.

This mixture makes an excellent cake put into a tin and baked till done (one hour at least.) Carraway seeds are good in this, but are apt to burn on the top of buns.

Rice flour may be used with advantage in making sponge-cake, sponge rolls, and light tea cakes. Use wheat and rice flour in equal proportions.

"COOKIES" OR DERBY CAKES.

Half-a-pound of wheat flour, ½ lb. rice flour, 1 teaspoonful of baking powder, ¼ lb. yellow sugar, a *few* currants, ¼ lb. crisco or lard, and 1 egg. Sift flower and baking powder together, rub in crisco, then add sugar and currants, beat the egg—if small, a teaspoonful of milk or paste must be added, very sparingly, for if too moist the paste will not roll out. Mix all together thoroughly, roll out and cut into cakes, ¼ of an inch thick. Bake a very light brown (10 to 15 minutes should cook them nicely.)

Plantain Flour Cookies:—To ½ lb: plantain flour put half a teaspoonful baking powder, sift together, rub in two ozs. crisco, add 2 ozs. sugar, a little ground-ginger or grated nutmeg, add milk or a *small* egg till the mixture is right for rolling: flour the board well, cut into cakes and bake a good brown. A morsel of candied peel, a split raisin, or a muscatel put in the centre improves their appearance only. About 15 minutes should cook them.

Corn-meal Cookies are excellent and keep well. Use the same proportions as for plantain Cookies, but they require slower and longer baking (20 to 25 minutes.)

SCONES.

Scones should be eaten hot if made with corn-meal alone, but if a little wheat flour be added they will be good and satisfying cold. Take half pound of corn-meal, $\frac{1}{4}$ lb. wheat flour, $\frac{1}{2}$ teaspoonful bicarbonate of soda, a little salt, and sour milk to mix. Sift the flour, salt and soda together, mix with the sour milk, roll, shape and bake on hot plate or girdle. If wanted richer, margarine or lard may be added. Cold boiled cassava mashed free from lumps and mixed with a little baking powder, the yolk of an egg and a little salt, makes good scones.

COCONUTS.

The uses of grated coconut are numerous. In cake making and as a filling for open or closed tarts, in giving daintiness to curries, in flavouring and in the form of coconut cream or milk, it is very good.

Coconut Cream :— The nut should be grated. To each cupful of grated nut put one of boiling water, let it stand till cold and strain. This can be used in puddings in place of cow's milk.

Grated coconut mixed with yellow sugar, grated nutmeg or other spice and a few currants, is a good and cheap filling for patties. A little of the mixture added to cassava or other puddings add to their richness. It is also a nice addition to corn meal or other cookies. For confectionery it takes the form of sugar cakes, coconut drops, ice candy, etc., and is wholesome and nourishing.

BANANAS.

Bananas are a food in themselves without cooking, but they lend themselves to many very easily made and inexpensive sweet dishes.

As fritters they are simply sliced, dipped in any batter, dried and sugar sprinkled over them when done. If too ripe to slice they may be beaten up in batter.

Banana Compote:—Boil together one cupful of sugar, one cupful of water, a small piece of cinnamon bark, the grated peel of a lime and a teaspoonful of lime juice. When boiling, lay in as many pieces of banana as the pot will hold—the pieces can be cut an inch thick.

Baked Bananas:—Peel and cut off the ends of the bananas, split them, sprinkle with a teaspoonful of sugar and one teaspoonful of lime juice. Bake in a hot oven for 20 minutes.

For Banana Jam and Jelly (see " Jams.")

Bananas sliced thinly and sprinkled with sugar may be layered in boiled cassava or bread-fruit puddings.

JAMS, JELLIES AND PRESERVES.

The following directions for jam and jelly making were written when white sugar was cheaper; they may still be followed; but for war-time cookery yellow sugar, which is less than half the price, must be substituted.

It must be remembered that jam or jelly made with yellow sugar requires *quite 10 minutes longer boiling*, and all scum rising must be carefully taken off

All fruits used as stews, jams or preserves of any kind, should be boiled till tender with spice or other flavouring and carefully skimmed before the sugar is added. Less sugar is required and a better result obtained in this way than when, as is frequently done, all are put on together.

(*Extract from " The Journal of the Board of Agriculture" January 1909 Vol. II. No. 3.*)

For *Guava Jelly* the fruit must be cut and boiled for 20 to 30 minutes in sufficient water to cover it well, stirred with a wooden or enamelled spoon to loosen the seeds and prevent burning; than carefully strained through a course cloth or muslin; left a little while to settle, and then the clear water used in the porportion of 2½ pints to 2 lbs. of sugar.

Let the water boil, then add the sugar and a piece of alum about the size of a small cherry. From the time it starts boiling again it must boil as fast as possible for 20 minutes : the pan must be large, so that its contents will not require constant stirring to prevent boiling over; as every time a cold spoon is put in it receives a check and so requires longer cooking. To make a clear, bright jelly very fast boiling is essential. Have a piece of cellular cloth or coarse muslin ready, strain the jelly immediately, put into bottles, fill full, and screw down at once.

Pine-apple Jam :—This requires great care as it burns very easily. The fruit must be chipped or grated, weighed, or measured boiled in its own juice or, when necessary a little water may be added. Then to every pound or pint allow one pound of granulated sugar and boil quickly, stirring constantly for 30 minutes or even a little longer if it is to be kept long or exported.

Carambola Jam : The fruit must be prepared by cutting off the acute edges, then cutting into pieces about ¾ inch thick ; boil 2½ lbs in 1½ pints of water till tender, which will take about 15 minutes; then add 2 lbs. of best granulated sugar and boil for 15 to 20 minutes. The seeds give a delicious noyeau flavour.

The same quantities of fruit, water and sugar, and the same time for boiling does for *Sorrel Jam*; this is improved by addition of a few cloves.

Sorrel Jelly. For this the fruit must be boiled to a pulp, strained, and 2 lbs, of sugar with a few cloves added to every 2½ pints of juice. As in guava jelly, it must be strained when finished, and corked or screwed down immediately.

Orange Marmalade. For making this in the tropics, where the fruit is fresh and the rind full of the essential oil, very few of the recipes given in cookery books answer.

The fruit should be cut in quarters, the flesh separated and soaked in sufficient water to cover it, the peel in *salt* and water. The peel must be boiled in two or three waters: the first with salt to extract the bitterness. As soon as the water boils it must be poured off. If the peel be boiled more than a minute or two with the salt no after boiling will make it tender. In the last water it must boil till soft enough to rub between finger and thumb. Then cut into thin slices, scraping away the white flesh. Next, well rub the figs of flesh to get all possible juice and gelatinous matter out, and strain; boil 2½ pints of this juice with 2½ lbs. of sugar. When nearly done—in 15 to 20 minutes—add 1½ lbs. of sliced peel, boil together very slowly for 5 or 6 minutes:—if boiled longer the peel will harden. Orange marmalade if properly made, bottled and covered while hot improves by keeping.

Green Mango Jam. Grate full green mangoes; to every 4 cupfuls of grated fruit put 2 cups of water, a bit of ginger: or cinnamon (ginger gives the best flavour); boiler till tender stirring frequently; when soft add 3 cups of yellow sugar, boil till it is quite thick, stirring constantly with a *long* enamel or wooden spoon, as it jumps and splashes badly when nearly done. Allow 10 to 15 minutes to boil the mangoes, 20 to 30 to boil the jam. Note:—*Never* use an iron spoon to stir fruit or jams, it blackens them and spoils the flavour. Mango jam is delicious when carefully made.

A nice way of cooking mangoes for desert or to eat with bread or pudding, is to cut the mangoes in strips; to every pound of mango put 1½ pints of water and a bit of ginger; boil slowly till tender, stirring carefully so as not to break the strips; when soft add ¾ lbs sugar to each lb. of fruit, boil slowly again for 30 minutes When cold it should be pretty to look at, *i.e.*, strips of fruit in jelly—and dainty to eat.

Green Papaws may be used in the same way, but they require the addition of lime juice to give the necessary acidity. Green papaws make a fair substitute for apples, used in tarts or for sauce. For sauce, spice should be omitted.

Mammee Apples are used for jam and jelly—for jam, exactly like green mangoes. Care must be taken to avoid the white pith under the skin, which is very bitter.

Golden Apples are stringy and fibrous and should be boiled till they will pulp through a sieve. Allow 2 cups of pulped fruit to 1½ cups of sugar and use cinnamon or cloves for flavouring. They require constant stirring while boiling.

Cherries, Gooseberries, Hog plums, and *Governor plums*—(commoly called " Sidiums")—are best made into jellies, on account of the tense skin and seeds. Use the same proportions of strained water and sugar as for guava jelly.

Sorrel makes a bright crimson jelly and is a good substitute for red currant jelly which it resembles in appearance and taste. Pick the red calyx from the seeds and steep in water to cover, with a few cloves, for an hour or so; then boil in the same water till mashed ; strain through muslin or crash, and allow 2½ pints of strained water to 2 lbs. yellow sugar.

A coarse jam is sometimes made from the red calyx, after being soaked for Sorrel drink

Sorrel Syrup. Boil and strain the red calyces, add to 2 pints of the strained water a few cloves, and 1 lb. of sugar ; boil till it is a thick syrup; bottle while hot. A tablespoonful swizzled in water makes a cooling and healthful drink.

Soursop makes a good opaque jelly. It should be peeled, boiled and strained, left to settle and the clear water used in the proportions of 2½ pints to 2 lbs. sugar.

Bananas, cut, boiled and pulped make a good jam for immediate use; they require the addition of spice and lime juice, and sugar to taste.

Banana Jelly, is also good for immediate use, but has no keeping qualities.

There are so many other fruits that are better for jams and jellies, that bananas are rarely used, more particularly as they have so many other uses.

CHUTNEY.

A simple, cheap and good way of making a most appetizing Chutney from green mangoes or green papaws is:—Grate mangoes or papaws and boil in enough water to keep from burning. When cold, measure, and to 2 cups of fruit, put 1 cup dark sugar, 1 cup brown vinegar, 1 or 2 blades of garlic, one or two onions chopped or pounded finely and red peppers to taste, (also pounded); boil over a slow fire till quite thick, stirring with a long spoon or stick, as it splashes like mango jam; put hot into screw-topped or tightly corked bottles and while hot, cover.

Chutney made carefully will keep for months.

There is never a month that some fruit is not available, for jam, jelly or stewed fruit. Many of these fruits are excellent substitutes for imported preserves. Many of them have a distinct flavour and adaptability to the need of residents in tropical climates; and in time should be largely used on account of their cheapness and freshness, and to avoid the large waste of good nourishing food so often seen and written about by those interested in the welfare of the people of the of the colony

WEIGHTS AND MEASURES.

Wheat Flour or Banana Flour.

4 level table-spoons full, weigh 1 oz.
1 cup full weighs ¼ lb.

Cassava Flour.

2 table-spoons full weigh 1 oz.
1½ cups full weigh ¼ lb.

Corn Meal.

3 level cups full weigh 1 lb.

Sugar.

1 heavy table-spoon full weighs 1 oz.
7 spoons full = 1 cup.
2 cups full weigh 1 lb.

Lipuid,

2 cups = 1 pint.
16 spoons full = ½ pint.

Obituary.

BENJAMIN GAINFORT,

Born 11th Feby., 1861, Died 24th Jany., 1926.

It is with extreme regret that we have to record the death of Mr. Benjamin Gainfort, late Chief Commissary of this Colony, which occurred in England on the 24th January, 1926.

Mr. Gainfort was appointed an Assistant Commissary in 1893 and a first-grade District Commissary in the following year. He was appointed Chief Commissary in January, 1920, and retired on pension on November 1st, 1924. While a Commissary, he also acted as Superintendent of the Botanic Gardens from April, 1902, to October, 1904. Mr. Gainfort first became a member of the Board of Agriculture on the 8th July, 1902 whilst acting in the above capacity, and when he ceased to so act in October 1904, on the suggestion of the late Sir Alexander Ashmore, he was made a personal member of the Board with the object of securing his somewhat exceptional knowledge of drainage, irrigation, livestock especially horse kind, and tropical agricultural matters generally, as an assistance to the Board and to the Department of Agriculture. Mr. Gainfort's length of service on the Board was exceptional, viz., 22 years. He has been throughout his period of service a very regular attendant at the meetings of the Board and especially of those of such of its Committees he has been appointed to, and has been of great assistance to the Board of Agriculture in many ways.

At a meeting of the Board of Agriculture held on the 3rd February last year, at which the Governor presided, the Board unanimously decided to respectfully suggest to His Excellency that Mr. Gainfort who was an energetic member of the Board from 1902 to his retirement, should be made an Honorary Member of the Board. This proposal His Excellency was pleased to accede to.

Mr. Gainfort leaves a widow and two children, to whom we tender our sincere sympathy in their sad bereavement.—J. B. H.

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during 1925.

The corresponding figures for the two previous years and the average for the sixteen years prior to that are added for convenience of comparison.

Product.	*Average 1907-22.*	*1923.*	*1924.*	*1925.*
Sugar, tons ..	99,646	83,166	85,896	97,714
Rum, gallons ...	2,753,607	420,996	769,308	1,148,119
Molasses, gallons ...	122,547	65,997	1,160,757	1,345,243
Cattle-food (Molascuit) tons	4,509	814	1,102	1,268
Cacao, cwts. ...	367	None	None	None
Citrate of Lime, cwts.	164	None	None	None
Lime Juice, gals. ...	*10,181	11,019	9,785	8,430
Essential Oil of Limes, gals. ...	*390	218	396	306
Coconuts, thousands	1,630	2,650	1,560	1,363
Coconut Oil, gals. ...	*21,406	26,621	21,804	30,394
Copra, cwts. ...	1,163	8,401	16,508	17,278
Coffee, cwts. ...	2,716	4,778	4,581	5,964
Kola-nuts, cwts. ...	12	None	None	None
Rice, tons ...	6,728	3,971	4,470	6,918
Ricemeal, tons ...	764	None	None	None
Cattle, head ...	635	994	391	514
Hides, No. ...	4,986	5,916	8,902	9,801
Pigs, No. ...	715	455	427	889
Sheep, head ...	66	37	37	14
Balata, cwts. ...	10,682	9,164	12,234	8,079
Charcoal, bags ...	61,017	44,295	42,040	32,625
Firewood, Wallaba, etc., tons	8,121	7,674	6,477	6,143
Gums, lbs. ...	2,919	2,588	708	477
Lumber, cub ft ...	232,502	114,062	180,863	146,561
Railway sleepers, No.	9,159	8,916	39,238	39,779
Rubber, cwts. ...	70	12	35	96
Shingles, thousands	2,458	1,374	1,278	1,892
Timber, cub. ft. ...	181,420	152,168	168,454	216,749

* Average for seven years 1916 to 1922 only. No records available prior to 1916.

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330
1925 :								
1st quarter	1,019	1,012	337	516	412	610	709	4,615
2nd ,,	624	582	350	478	...	417	361	2,812
3rd ,,	953	539	361	387	...	326	231	2,797
4th ,,	721	622	532	438	58	310	296	2,977

Meteorological Data 1925.

BOTANIC GARDENS, GEORGETOWN.

1925. MONTHS.	Rainfall.	Number of Days of Rain.						Evaporation
	Inches.	Under .10 in.	.10 to .50 in.	.50 to 1.00 in.	1.00 to 2.00 in.	Above 2.00 in.	Total Days.	Inches.
January	3.70	10	10	2	...	...	22	4.62
February	2.21	14	4	1	...	...	19	5.83
March	14.82	5	7	4	4	1	21	4.67
April	4.29	6	7	2	1	...	16	4.71
May	5.96	4	9	2	...	1	16	5.22
June	7.84	7	14	2	2	...	25	4.32
July	8.67	5	13	1	3	...	22	4.62
August	6.54	9	6	1	2	...	18	4.78
September	3.04	3	...	...	...	1	4	6.54
October	.87	3	3	...	...	...	6	5.99
November	.53	2	1	...	...	...	3	5.83
December	4.78	6	6	3	...	...	15	4.88
TOTALS.	63.25	74	80	18	12	3	187	61.51

Stations.	Wettest Day.	Rainfall. Inches	Hottest Day.	Temperature.
Botanic Gardens, Georgetown ...	15th March	6.00	30th Aug.	90.0
New Amsterdam Public Gardens...	28th May	2.60	5th Sept.	95.0
Onderneeming Essequibo ...	21st March	2.65	22nd and 25th Sept 24th Oct.	93.0
Morawhanna N.W.D. ...	26th March	1.59	...	...

AIR TEMPERATURE AND HUMIDITY IN THE SHADE, BOTANIC GARDENS, GEORGETOWN, 1925.

Months.	Air Temperature.			Humidity.
	Maximum.	Minimum.	Mean.	Mean.
January ...	82.6	73.5	78.0	79.5
February ...	83.4	74.3	78.8	78.0
March ...	83.6	74.1	78 8	80.2
April ...	85.1	75.6	80.3	78.8
May ...	85.5	75 4	80.4	77.9
June ...	85.2	74.9	80.0	81.6
July ...	86.2	75.7	80.9	79.9
August ...	86.2	75.3	80.7	81.1
September ...	87.2	75.8	81.5	77.8
October ...	87.9	75.8	81.8	75.8
November ...	87.5	75.9	81.7	76.1
December ...	86.3	75.2	80.7	76.3
Mean ...	35.6	75.1	80.3	78.6

JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XIX. APRIL, 1926. No. 2

MEETING OF THE BOARD OF AGRICULTURE

A Meeting of the Board of Agriculture was held in the Court of Policy Hall on Friday, the 26th day of February, 1926, at 2.30 p.m. His Excellency the Governor, Sir Cecil Rodwell, K.C.M.G., presided, and there were present W. Francis, Esq., F.I.C., Acting Chairman, (Acting Director of Science and Agriculture), Hon. G. D. Bayley, C.B.E. (Commissioner of Lands and Mines), S. H. Bayley Esq., (Director, Colonial Transport Department), L. D. Cleare, Jr., Esq., F.E.S. (Government Economic Biologist), Dr. C. L. Whittles, (Superintendent, British Guiana Sugar Planters' Experiment Stations), G. E. Anderson, Esq. (Representative of the Royal Agricultural and Commercial Society), Captain E. Beckett, F.L.S. (Deputy Director of Agriculture for Essequibo), Hon. R. E. Brassington, Hon. J. J. da Silva, H. L. Humphrys, Esq , E. M. Walcott, Esq., F.R., A. Seton Milne, Esq., (Government Veterinary Surgeon), H. A. Britton, Esq. (President of the British Guiana Farmers' Conference) Dr. F. T. Wills, C. R. Williams, Esq., with Mr. E. M. Peterkin, Secretary.

Mr. Humphrys welcomed His Excellency on behalf of the Board, and expressed the hope that he would find time to attend other meetings.

Mr. da Silva endorsed Mr. Humphrys' remarks and added that knowing as he did that His Excellency was travelling over the country and seeing conditions for himself, his attendance at the meetings of the Board would be very useful.

His Excellency: I must thank Mr. Humphrys and Mr. da Silva for the very kind words with which they have welcomed me. This is the first occasion on which I am presiding at a meeting of this Board, I understand it is not the practice for the Governor, although he is the President of the Board to attend the meetings unless they are special meetings. I am glad however, as this is the first meeting to be held since I have arrived in the Colony, to preside, and I shall certainly have no hesitation in presiding on future occasions if there is any special reason why I should do so.

The Acting Chairman tendered excuses on behalf of W. M. B. Shields, Esq., R. Strang, Esq., and the Director of Co-operative Societies (G.L.B. Gall, Esq.).

The minutes of the previous meeting held on September, 30th, 1925, having been circulated to the Members of the Board and having received their approval were on the motion of Mr. H. L. Humphrys, seconded by Mr. S. H. Bayley, taken as read and confirmed.

His Excellency said: Before the Board proceeds with its business. I am going to ask you to agree to a resolution with reference to the death of Sir John Harrison. Sir John Harrison, the late Chairman of the Board died on the 8th of February, after 36 years' service in the Colony. Before arriving here in 1889 he served for over ten years in Barbados as Island Professor of Chemistry and Agricultural Science. He became Director of Science and Agriculture in 1905, was created C.M.G., in 1901 and Knighted in 1921. He also held the appointments of Chairman of the Board of Agriculture, Government Analyst and Geologist, Chairman of the B.G. Sugar Planters' Experiment Stations Committee, and was *ex officio*, a Director of the Royal Agricultural and Commercial Society. He was made a member of the Executive Council in 1918. As Chairman of the Board of Agriculture he was present at every meeting held from its inception on the 9th.

of August, 1901, except two, one in 1921 and one in 1922, when he was away from the Colony on leave of absence through ill-health. My own official association with the late Professor Harrison was but a brief one, extending only over a few weeks before he was taken ill, but I saw enough of his work to realize what a loss the Colony and Government have sustained. I do not think that I can describe him better than by the words used by the Secretary of State for the Colonies in the Telegrams of condolence which he sent the other day. Mr. Amery referred to Sir John Harrison 'as an officer of exceptional distinction.' Sir John Harrison carried on his work to the very last moment. In fact, it was only by my express orders that he could be induced to lay aside his work. Even as late as the 27th, January there is a minute on record by him about certain details of departmental administration, a minute which I may say displays all the force and virility which I believe usually characterised the product of his pen and I should like to say that I am indebted to the late Sir John Harrison for advice which he gave me the last time I had an official interview with him with regard to the re-organisation of the Department of Science and Agriculture as from the date when it was then hoped he would retire in order to enjoy the leisure which he had so well earned. The following is the resolution which I will ask the Board to pass and I suggest that out of respect we should pass it standing:—

"That the British Guiana Board of Agriculture
" desires to record its sense of the great loss sustained
" by the Colony and especially the agricultural interests
" in the lamented death of the late Chairman of the
" Board, Sir John Harrison, C.M.G., etc , and desires to
" convey its deep sympathy and condolence to Lady
" Harrison and other members of his family.'

Mr. Brassington Your Excellency, I have the very great privilege in seconding this resolution bearing testimony to the great services Sir John Harrison rendered to this Colony. I knew Sir John Harrison as far back as 1900 and from that date up to the date of his death, I have been associated with him on many public boards. I say in the fullest sense that it was a privilege to be permitted to be associated with Sir John Harrison on any board or in any policy or public duty. As I said in the Combined Court at the annual session I do not suppose there was anybody in the scientific world who had the number of degrees and whose scientific attainments were so varied as Sir John Harrison. In agricultural science and anything that he took up, his services were of the greatest value to the Colony, and when we consider the numerous offices he held one cannot understand how he did it. He had a most marvellous memory and capacity for work that has never been excelled or equalled in this Colony. I feel certain that the remarks which fell from Your Excellency will be endorsed by every member of the Board and in this Colony, and, on this Board his memory will long live.

The motion was carried standing.

Mr. Walcott moved that the Board place on record its regret and sympathy with respect to the death of Mr. B. Gainfort, retired Chief Commissary, who, he said, had served the Colony for many years and was never afraid to say what he felt. This was seconded by Mr. G. E. Anderson, and unanimously carried.

His Excellency proposed that his predecessor, Sir Greame Thomson, K.C.B., be appointed an honorary member of the Board. This was seconded by the Hon. R. E. Brassington and unanimously carried.

The following were reported:—

The Acting Chairman reported that Messrs. G. E. Anderson, the Hon. J. J. da Silva, and Dr. F. T. Wills, who had been granted leave of absence had resumed their seats; also, that Mr. Thos. Earle had been granted three months' leave of absence.

Permission granted Mr. A. R. F. Webber to export two live Curri-Curri (Eudocimus rubra).

Permission to collect bird skins granted to Mr. T. A. W. Davis, Assistant Conservator of Forests.

Destruction of Guernsey Bull "Rooseveldt II" through old age.

The affiliation of the undermentioned Associations :—

Berbice Agricultural and Industrial Association.
Beterverwagting & Triumph Farmers' Association.
Buxton & Friendship Farming Association.

The Acting Chairman reported that Mr. R. Ward. Superintendent of the Botanic Gardens, had been granted six months' leave of absence at the expiration of which he would retire after forty years' service in the Department of Agriculture. He proposed that Mr. Ward be appointed an Honorary Member of the Board.

Mr. Britton, in seconding this motion said that Mr. Ward was really the friend of the small farmers to whom he gave practical demonstrations when he went into the country districts. He proposed to return to the Colony so that the Board would continue to have his advice.

Mr. Brassington suggested that a letter be written to Mr. Ward expressing the Board's appreciation of his services. He remarked that there was no doubt that Mr. Ward had rendered very valuable service to the Colony in a very modest way. He was one of those men who hid their light under a bushel, as those who had come into contact with him could not help being struck by his sound practical knowledge of Agriculture.

The motion was put to the vote and unanimously carried.

The change in the dates of the County Agricultural Show, New Amsterdam, Berbice, from the 4th, and 5th, March, 1926, to the 16th, and 17th, September, 1926, was reported.

The following were laid :—

Journal, Board of Agriculture, Volume XVIII.—No. 4.

Journal, Board of Agriculture, Volume XIX.—No. 1.

Letter of thanks received from Lady Hodgson, acknowledging letter of condolence from the Board on the death of her husband.

List of Registered Veterinary Surgeons for 1926.

List of persons authorised to inoculate and to brand animals under Section 32 (2) of the Contagious Diseases (Animals) Ordinance No. 5 of 1920.

Movements and Services of Bulls and Stallions for 1925.

Report on Agriculture Show held at Belfield E.C., on 6.10 25.

Report on Agricultural Show held at Stanleytown, W.B., on 27.10.25.

Report on Agricultural Show held at Mahaicony, E.C., on 25.11.25.

Report on a Farmers' Competition held at Buxton and Freindship, during 1925.

The minutes of the Veterinary Committee meeting held on 24.2.26., dealing with a letter from the Government Veterinary Surgeon as under:—

> " I beg to draw the attention of the Veterinary " Committee to the following : Estates can call " in vaccinators from outside to vaccinate the ani- " mals. Once a place has been proclaimed affected " with disease such as Anthrax, Glanders, etc., the " only one that should be allowed to vaccinate or " test these animals is the Government Veterinary " Surgeon, otherwise, he is not able to control the " disease. I would ask the Veterinary Committee " to make this a very strong point at the Board's " Meeting on the 26th Februray"

was next considered. After some discussion it was decided that the Veterinary Committee should deal with this matter and forward to the Board their decision as to the Amendment required to Section 36 of Ordinance 5 of 1920.

Information required with regard to the possibility of the fruits of "Mango" and "Pithecolobium," in the Colony being prepared as cattle food. This file had been referred to the Subsidiary Products Committee, which was of opinion that there was not a sufficient quantity of these trees being cultivated in the Colony to warrant further investigation, nor was there any likelihood of there being so in the near future.

An enquiry reproduction of Eddoes in British Guiana and regular shipments to be made to New York, was submitted.

A letter from Messrs. Gore Ltd., Jamaica, *re* a proposed co-operative Fruit Growers and Produce Growers Association was submitted.

PROPOSED AGRICULTURAL LOAN BANK.

Mr. Walcott asked what steps were being taken in the matter. The question was brought before the Board twelve months ago, and was in the same position at present. An Agricultural Loan Bank was of urgent necessity and he would like to see some serious action taken in the matter. Mr. Shankland might be brought in and asked to concentrate on such a bank, and his services could be utilised as a whole time officer.

His Excellency said that Mr. Shankland had been appointed on the Committee, and that he hoped that the government would be able to put some definite proposal before the Court of Policy and the Combined Court at an early date.

Allocation of vote XXXVIII. No. 56, Live Stock, purchase of, $1,200 00.

The Government Veterinary Surgeon suggested that the following be imported for 1926:—

Bulls—	2 Short Horn at $360 each	$ 720 00
	2 Freisian at $360 each	720 00
Sheep—	4 Rams H.B. unrelated at $98 each	392 00
	6 Ewes H.B unrelated at $98 each	588 00
Horse—	If required, $1,000 ...	1,000 00
Fowls—	Indian Game $25 per trio	25 00
		$3,445 00

After some discussion it was agreed that the Board should write the Government stating that in their opinion the additional stock mentioned above were required, pointing out that the sum available was $1,200, and asking that they consider the question of obtaining money from the Combined Court.

Mr. Britton suggested that arrangements might be made for the removal of the bulls and stallions from one police station to another at various times, for the benefit of the rural districts.

Mr. da Silva supported the suggestion made by Mr. Britton.

Allocation of vote XXXVIII No. 61, Grants-in-aid of Agricultural Associations, Exhibitions and Competitions for $2,500, as under, was approved of:—

Berbice County Show ...	$ 1,000 00
West Bank Show	200 00
Mahaicony Show	200 00
Beterverwagting Show ...	200 00
2 Farmers' Competitions ...	240 00
Affiliation Grants	160 00
Departmental Expenses ...	500 00
	$ 2,500 00

Questions by the President of the British Guiana Farmers' Conference, and answers to same:—

1. (*Q*) What steps, if any, have been taken or will be taken for eradication of the Congo Bush now growing so very luxuriantly in the Botanic Gardens?

"CONGO BUSH."

(*A*) Efforts have always been made to kill out the "Congo Bush" by means of continuous lopping in order to weaken the root-stocks which gradually decay. This though being a cheap method was found, however, to be a slow process.

Mr. Ward, Superintendent, Botanic Gardens, therefore took the matter seriously in hand at the begining of this year. The Prison gang in addition to free labour was put on to push forward the work, and has already cleared the Paddock, the whole of the southern section of the Gardens and also the greater portion of the Park Lands. The last portion of the eastern section of the Park Lands remains to be completed, and is being urged forward.

The method of eradicating this noxious weed is by completely digging out all tillering stumps and rootstocks, and destroying by fire. In some cases the stocks run underground for about 20 to 24 feet. Now that the subject of clearing the Gardens of this pest is well under control, it will be an easy matter to free the Park Lands of any stray shoots that may arise in future.

—(**Written by Mr. Abraham.**)

2. *Q*. Whether or not any steps have been taken by the Department of Science and Agriculture for the establishment of a Silk Worm Industry; if no such steps have been taken, will the Department now take the necessary steps by the importation of a lot of eggs for purposes of experiment?

A. While on leave in England last year the question of the possibility of establishing a silk industry in this Colony was discussed with the late Professor H. Maxwell Lefroy, who was an authority on sericulture. Professor Lefroy was of the opinion that climatic conditions would be against such an industry in this Colony, although some of the West Indian Islands would be eminently suitable. I also attended a meeting of the Imperial Institute Advisory Silk Committee with the delegates of the Imperial Entomological Conference when the question of silk production within the Empire was discussed. Since my return to the Colony I have gone into the question and am in corresqondence with the Silk Committee with a view of obtaining a trial parcel of eggs. In the meantime mulberry plants are being propogated.

The raising of silk worms depends primarily upon climatic conditions favourable to the growth of the worms and the mulberrry plant. The mulberry plant will, however, grow on any soil and in almost all climates. Assuming satisfactory local conditions, the first practical step is to obtain reliable opinion as to the qualities of the cocoons raised locally—their yield of silk and its reeling qualities—and finally a report on the silk obtained—its weaving qualities, etc.

Experience in other parts of the world has shown that sericulture can only be undertaken as a cottage or part-time industry by an industrious and dexterous people. It would be necessary for the women to carry out the rearing of the worms, which in their early stages require constant attention. In India the average family engaged in sericulture makes between $50 and $70 a year at such work. This amount would be considered highly profitable in India. Until the production of cocoons reaches a certain amount it is not a commercial proposition to erect a filature locally for reeling. Until recently this was the stage of the development of the industry even in Cyprus, and it is the stage on which Iraq is now entering. Cocoons from Cyprus are sent to France for reeling, and from Iraq to Calcutta. The freight on cocoons from this country would be high. Although the amount of raw silk entering commerce is roughly 70 million pounds yearly, the greater part of this comes from Japan and China, and the bulk of the remainder from Europe and Asia Minor. The only British countries that produce silk in commercial quantities are India and Cyprus. The United States, although not producing any raw silk, consumes 75 per cent. of the world's crop.

Experiments have been carried out in Jamaica—started in Oct. 1920.

Imperial Institute reported favourably on cocoons in December 1924—and considered that "the trials are "well worth continuing with the object of ascertain-"ing whether, when the necessary sericultural experience "has been acquired, Jamaica is capable of producing "cocoons of good commercial quality."

Jamaica Agriculture Society March 1925 adds "" Our efforts now are being concentrated to secure "enough good cocoons to carry through a reeling test. " According to the Institute this will require 25 pounds, " which is rather a large order for experimenters to produce."—(*By Mr. L. D Cleare.*)

3. *Q.* Has the Department of Science and Agriculture taken; if not, will it take the necessary steps to ascertain whether or not Black Head Borers are widespread in the Rice cultivation of the Colony; and, if so, what remedial measures have been adopted by the Department and recommended to the cultivators of Rice for the extermination of the Borers?

A. Black-headed Borers, that is Diatraea saccharalis F. have been known to occur in rice for a number of years, but it is only recently that they have been reported as doing any appreciable damage in one locality. On several occasions when they have been observed they were attacked by parasites. It is proposed to investigate this question during the coming rice crop, and suitable remedial measures will then be recommended.—(*By Mr. L. D. Cleare.*)

4. *Q.* When last has the Board met at the Botanic Gardens for the purpose of inspecting the plants, live stock, &c.?

(b) Why has so very wholesome a custom been abandoned or suspended?

(c) Will steps be taken for the revival of the practice and a date fixed for such a visit by the Board?

A. On October, 10th. 1913.

5. *Q.* What are the varieties of Mangoes, which in the opinion of Mr. Bartlett when Government Botanist, if carefully picked and unbruised would keep long enough to be exported to England.

(b) Has the Department of Science and Agriculture at any time taken steps to and/or actually recommended to the small farmers the cultivation of such varieties?

A. See "Official Gazette" of 17th June, 1908, F. 1523, which will be published in an early number of the Journal of the Board of Agriculture.

Application for a District Agricultural Show to be held at Beterverwagting and Triumph on 10th August, 1926, was approved of.

APPOINTMENT OF AN INSPECTOR OF AGRICULTURAL PRODUCE.

The following resolution passed by the County of Essequibo Agricultural Association at their General Meeting, held on February 22nd, 1926 was submitted:—

RESOLUTION.

"That the Committee of the County of Essequibo "Agricultural Association begs to bring before the "Board of Agriculture what it considers to be a matter "of supreme importance and urgency, namely, the "appointment at a date as early as possible, of an "Inspector or Authority for inspecting and standardis-"ing all exports of Agricultural produce. It also "considers that such inspection should be done on the "wharfs in Georgetown before shipment abroad."

This was referred to the Agricultural Exhibitions Committee of the Board of Agriculture.

Application from Mr. D. D. Haynes for the post of Coconut Inspector.

The Acting Chairman mentioned that an application had been received from Mr. D. D. Haynes, who was taking studies at the Imperial College of Tropical Agriculture, Trinidad, for the post of Coconut Inspector in this colony.

The Hon. R. E. Brassington said that agricultural instructors attached to the Department of Science and Agriculture visited various estates and ordered the destruction of diseased coconut trees and he did not see the necessity—if the Board had the power already —of appointing a new man. He did not want to do anything to hamper agriculture but he thought the machinery was already in existence.

Mr. Britton said that the question of the appointment of a Coconut Inspector arose at a meeting during

Mr. Brassington's absence from the Colony, and the Board decided on the motion of Mr. Strang, to petition Government to place on the Estimate a sum for that purpose. Mr. Haynes happened to be a student from this Colony at the Agricultural College in Trinidad and was taking up studies to suit himself for the position, if appointed. He believed that the amount was put on the estimates on the advice of the Board. If the appointment did not rest with His Excellency, he would move a motion that Mr. Haynes be appointed.

His Excellency said he had been informed that the appointment rested with the Government and there was therefore no need for a motion.

On the motion of the Acting Chairman seconded by the Government Veterinary Surgeon, the undernoted Orders under Section 23 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920 were unanimously confirmed:—

DATE OF ORDER.	AREA DECLARED.	DISEASE
18th January, 1926.	At Pln. Providence, East Bank, Demerara, bounded on the North by the side-line opposite Head Overseer's house, on the South by No. 3 Canal, on the East by the Public Road, and on the West by the Demerara River.	Anthrax.
5th February, 1926.	At Pln. Providence, East Bank, Demerara, bounded on the North by Eccles side-line on the South by No. 3 Canal, on the East by the Lamaha Canal, and on the West by the Public Road, Providence North side-line and 84 X Dam.	Anthrax.
5th February, 1926.	At Pln. Tuschen, West Coast, Demerara, bounded on the North by the Atlantic Ocean on the South by the Railway line, on East by Zeelught side-line, and on the West by Tuschen side-line, At Pln. Tuschen,	Anthrax.

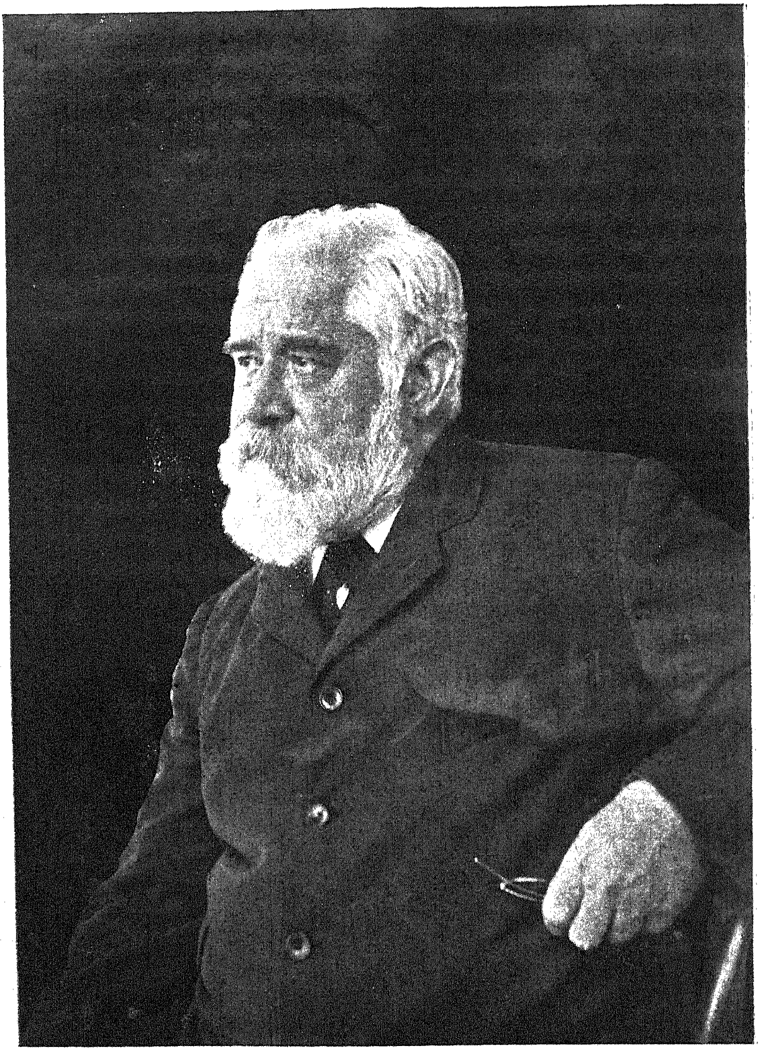
DATE OF ORDER.	AREA DECLARED.	DISEASE.
5th February, 1925.	At Pln. Tuschen, West Coast, Demerara, bounded on the North by the south trench running alongside the public road, on the South by the Boerasiri Canal, on the East by Tuschen east side-line and on the West by Tuschen west side-line.	Anthrax.

Brand to be used on all animals inoculated against Anthrax.

On the motion of the Acting Chairman seconded by the Government Veterinary Surgeon the above Orders under Section 23 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920 were unanimously revoked.

Order No. 543, dated 24th June, 1925, published in the "Official Gazette" of 27th June, 1925, exempting race horses from examination by the Government Veterinary Surgeon, was revoked.

The Chairman then adjourned the meeting to a date in May to be fixed later.



J. B. Harrison

OBITUARY.

SIR JOHN BURCHMORE HARRISON, C.M.G., M.A., F.I.C., F.G.S., ETC.

Born 29th May, 1856—Died 8th February, 1926.

It is with extreme regret that we have to record the death of Sir John Burchmore Harrison, C.M.G., Director of Science and Agriculture and Chairman of the Board of Agriculture, which took place at the Public Hospital, Georgetown, on the 8th February, 1926.

Sir John Burchmore Harrison was born near Birmingham, Warwickshire, on 29th May, 1856. He was the son of John Harrison, a cotton merchant, and Anne Burchmore of Lincoln.

He studied Chemistry at the Edgbaston School under the late Dr. G. Gore, F.R.S., and Mr. C. J. Woodward, B.S., and in 1871 at the age of 15, sat the Oxford Local Examinations being placed third in the 1st class of the Natural Science Section, his subjects being Chemistry and Physics. He also studied Geology and Mineralogy, under the late Revd. Dr. George Deane of the Midland Institute, and in March, 1874, was awarded an open Scholarship in Natural Science at Christ's College, Cambridge, his subjects being Chemistry, Physics, Geology and Mineralogy. In May, 1874, he was placed First in the 1st class of the Natural Science Division of the Oxford Senior Local Examinations, his subjects being Chemistry, Physics, Geology and Mineralogy specialising in Analytical Chemistry; and in the same month received a 1st class in Honours at the Science and Art Department Examination again specialising in Chemical Analysis. He was awarded the Queen's Medal for that year in Geology and Mineralogy and was also awarded a special Scholarship in Science from the Edgbaston School.

He was reading Chemistry, Physics, Geology and Mineralogy at Cambridge from October 1874 to 1877 when he passed Part I of the Natural Science Honours in June of the latter year. In January, 1878, he completed his degree in Part II of the Natural Science Tripos, specialising in Chemistry with stress on Analytical Chemistry. Among his contemporaries were Professor Bower of Glasgow, the eminent Chemist Fenton of Christ's, and Adam Sedgwick of Trinity. Until December of that year he was at Cambridge University, pursuing a post-graduate course in Analytical Chemistry and assisting the late W. J. Sell, D.Sc., F.R.S., formerly University Demonstrator in Organic Chemistry, in specialised Analytical Research. From January to July, 1879, he was Lecturer on Chemistry at Berkhamsted School. In April of that year he was appointed to the newly created post of Island Professor of Chemistry and Agricultural Science at Barbados, B.W.I., by the late Professors Sir James Dewar and Dr. Liveing of the Cambridge University Laboratories. In July to September, 1879, he resumed his post-graduate studies in the Cambridge University Laboratories, and at Rothamsted Experimental Station, under the guidance of Sir John B. Lawes and Dr. Gilbert, specially devoted himself to Agricultural Chemistry. He took up his post in Barbados in September of that year. On September 19th, 1925, he received a letter from Sir Daniel Morris congratulating him on the record he had made for length of time, etc., in active scientific research work in the British West Indies and British Guiana. We may mention that from 1872 to 1879, he was an active member of the Birmingham Natural History Society being the Secretary of its Geological section; this supplied him with many opportunities of examining coal, ironstone and limestone mines in the South Stafford Coal District as well as lead and other metalliferous mines in North Wales.

Prior to his coming to this Colony in 1899 as Government Analyst and Professor of Chemistry, Professor Harrison as he was then known, was already recognized in Barbados and the other West India Islands as a scientist of repute. The results accruing from his pioneer work in conjunction with that of Mr. J. R. Bovell on the raising of new varieties of sugar cane from seed have been of incalculable value to the Sugar Industry of the world. His training at the Rothamsted Experiment Station bore early fruit by the inauguration in 1886 of the Manurial Experiment with Sugar Cane at Dodds, Barbados. These and similar experiments conducted by Sir John in the Botanic Gardens here, soon established him as an authority on the manurial requirements of the sugar cane. The value of these experiments was greatly enhanced by the degree of accuracy with which the analysis of the various soils, manures and sugar-cane products was carried out. It was here that Sir John Harrison's knowledge and skill as an analyst was most prominent, the majority of these analysis being performed by himself, as his laboratory note-books show.

In 1905, in addition to the posts of Government Analyst and Geologist, on the organization of the Department of Science and Agriculture, Sir John was appointed to be its Director. Two years later he was instrumental in causing this *Journal* to be started.

Sir John was for many years an active member of the Royal Agricultural and Commercial Society of British Guiana, being a Director at the time of his death. He was President of that Institution in 1897 and again in 1918 after a lapse of 21 years. He was a member of the Board of Agriculture from its inception in 1901 and was present at all the meetings of the Board, save when he was absent from the Colony. Sir John was also a member of the Executive Council of British Guiana from 1918 until his death, and of numerous boards and committees during his long period of service.

A most important achievement was the establishment in 1919 of the B. G. Sugar Planters Experiment Stations. It was largely if not entirely due to Sir John's influence that the Sugar Planters of the Colony co-operated in this scheme which had been in their minds for over thirty years. No higher tribute could have been paid to Sir John Harrison than this successful co-operation of the planters to extend under his direction the sugar-cane experiments started by him in the Botanic Gardens.

In 1901, Sir John was rewarded for his services with the C.M.G., and in 1921 he received the Honour of Knighthood. In 1887 while in Barbados, Sir John was elected a Fellow of the Institute of Chemistry on account of his professional standing. Later he was elected a Fellow of the Geological and Chemical Societies of London and of America, and of several other similar associations in England and the U.S.A.

It is not within the scope of this notice to deal with Sir John's multifarious activities in the realms of scientific research. It is sufficient to say that Geology and Microscopy were to him a form of recreation, and his travels in the British West Indies and the interior of British Guiana in connection with Geological enquiries must have been to him a labour of love.

By Sir John Harrison's death the Board has lost its oldest and most valued member, the Department of Science and Agriculture, a father and wise administrator, and British Guiana its most distinguished and self-sacrificing colonist.

Sir John Harrison was married in 1881 to Hortense, daughter of Mr. J. P. Carter of Barbados, by whom he had one daughter now wife of Mr. H. A. Frere of Roydon Hall, Diss, Norfolk, and one son who died in 1922 whilst Medical Officer of Singapore. To Lady Harrison and family, the *Journal* expresses its deep sympathy.

OBITUARY.

ALFRED SETON MILNE M.R.C.V.S., F.E.V.M,S. ETC.

Born 26th April 1874—Died 11th March, 1926.

We regret to have to record the death of Mr. Alfred Seton Milne, which sad event took place somewhat suddenly at his residence, 68 Croal Street, Georgetown, on the 11th March, 1926.

Mr. Milne was born at Ladykirk, Scotland, on the 26th April, 1874. He was educated at Geo. Watson's College, Edinburgh, and graduated M.R.C.V.S. in 1894 at the early age of 20. He commenced to practice in his profession with Mr. Storey in East Linton and afterwards set up in independent practice at Berwick-on-Tweed. He came to the Colony in 1904 when he was appointed Municipal Veterinary Surgeon. During the following years Mr. Milne identified himself with matters pertaining to his profession; he also became a devoted racing enthusiast, and the owner of a fine string of animals. Extending his studies, Mr. Milne obtained while on a visit to his home country the further diploma of F.E.V.M.S., and on July 1st 1914, on the retirement of Mr. J. A. Raleigh, he was appointed to the post of Government Veterinary Surgeon.

Being full of energy, Mr. Milne devoted himself whole-heartedly to his work. He became a member of the Board of Agriculture 1921, and as a member of several sub-committees of the Board his advice on matters veterinarian was much sought after. In addition to his Municipal and Government appointment the deceased had an extensive and lucrative private practice.

Mr. Milne was exceedingly popular throughout the Colony and in addition to being an enthusiastic oarsman, took a keen interest in cricket and other sports and in later years became a keen golfer.

In 1905 Mr. Milne married in Georgetown, Miss Morton of Seton Delaval. He leaves a widow, an aged father, two brothers and a sister to mourn his untimely death; to all of whom we tender our deep sympathy in their sad bereavement.

REPORT ON THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE HELD IN LONDON IN JUNE 1926, AND VISIT OF COLONIAL AGRICULTURAL OFFICERS TO ROTHAMSTED EXPERIMENT STATION.

By L. D. Cleare, Jr. F.E.S., F.L.S. Government Economic Biologist, British Guiana Delegate.

I.—The Second Imperial Entomological Conference.

The Conference, which commenced on Tuesday, June 9th and lasted until Thursday, June 18th was opened by the Right Honourable Earl Buxton, Chairman of the Managing Committee of the Imperial Bureau of Entomology. In addition to many of the most prominent entomologists of Great Britain, there were present twenty-two delegates from the Dominions and Colonies representing the Governments of the Union of South Africa and Southern Rhodesia, the Commonwealth of Australia, Western Australia, Canada, Ceylon, Egypt, Gold Coast, India, Irish Free State, Northern Ireland, Kenya, New Zealand, Nigeria, Northern Rhodesia, Sierra Leone, the Straits Settlement and the Federated Malay States, Sudan, Tanganyika Territory, Tasmania, Trinidad and Uganda.

After receiving the delegates Lord Buxton addressed the Conference and first referred to the loss sustained by the Bureau through the death of Viscount Harcourt, who had taken such a great personal interest in the work of the Bureau.

Lord Buxton said that the previous Conference held in 1920 had recommended that the Bureau should be in possession of an income of £13,000 a year, and he was pleased to think that that sum, as the minimum revenue of the Bureau was now in sight. If, at the same time, increased funds are forthcoming the operations of the Bureau could be extended, and he mentioned the very large sum amounting to about half a million sterling that was at the disposal of the United States Bureau of Entomology.

He cited figures from a memorandum which had been prepared by the Director on the work of the Bureau from April, 1920, to March, 1925, to show the increase in the work of the Bureau that had taken place since the last Conference, The most striking of these was the increase that had taken place in the identification of insects. In 1920-21 the number of collections received and examined numbered 187 and contained some 29,800 specimens while in 1924-25 the collections received numbered 347 and contained over 63,676 specimens. When the present position in regard to entomological problems was considered it was clear that the reasons which led to the formation of the Bureau in 1913 were now more powerful than ever, and the absolute necessity of some central body that could act as a "clearing house" with regard to entomological matters was becoming more and more evident.

The opening meeting of the Conference was the Business Meeting which was devoted to the consideration of the work and finances of the Imperial Bureau of Entomology. A memorandum on the work of the Bureau from 1st April, 1920, to 31st March, 1925, was circulated amongst the Delegates and Dr. G. A. K. Marshall, the Director of the Bureau, in referring to the memorandum gave an account of the origin and early history of the Bureau.

In addition to the figures above with regard to the identification of insects the memorandum dealt with the other phases of the work of the Bureau amongst which are the publications issued by the Bureau, namely, the Review of Applied Entomology and the Bulletin of Entomological Research. The *Review of Applied Entomology* is a publication in which is collected abstracts of all papers on economic entomology throughout the world, and deals with both insects injurious to plants as well as those harmful to man and domestic animals. The preparation of this publication is probably the most important duty of the Bureau and involved a vast amount of work, and during the last quinquenial period the number of articles abstracted averaged 2,309 annually. The review, which is now in its thirteenth year, has become an essential publication to every worker in economic entomology. The *Bulletin of Entomological Research* on the other hand deals mainly with the more technical and taxonomic aspect of the subject, and publishes papers which are not suitable for the local publications of the various Departments of Agriculture. Copies of both these publications are received free of charge from the Bureau by this Division, while the Division has been accorded the publication on several papers through the courtesy of the Bureau since its inception.

Another important duty recently assumed by the Bureau is the preparation and publication of the Insecta part of the Zoological Record. Without the Zoological Record it would be almost impossible to keep in touch with the vast literature on systematic entomology, and the identification of insects would soon be in a chaotic state.

Another line of work upon which the Bureau has recently embarked is the export of beneficial parasites. The position of the Bureau in this respect should be defined unless some misunderstanding occur in this colony on the work. This line of work was the outcome of a request from Dr. R. J. Tillyard from New Zealand who some two years ago wrote asking "whether it would not be possible for the Bureau to make arrangements to supply useful European parasites that might be needed in various parts of the Empire...... he mentioned that he was particularly anxious to obtain parasites of the European earwig, which was increasing to a serious extent in parts of New Zealand."

Special consideration was given to this question and "it was felt that the Bureau could do valuable work in this direction on behalf of certain of the Overseas Governments, but that it might be necessary in certain cases to ask for a special grant from the Government concerned if the supply of a particular parasite should involve costly investigations." The Conference approved of the estimate of £1,440 ($6,912) annually for this work.

During the Conference visits were paid to the Universities of Oxford and Cambridge, to the Rothamsted Experiment Station at Harpenden, to the Pathological Laboratory of the Ministry of Agriculture, and to the British Museum (Natural History), while meetings of the Imperial Institute Advisory Committee on Silk Production, the Zoological Society and the Linnean Society were attended.

Papers on various aspects of economic entomology were read by several of the delegates during the Conference, and short summaries of some of these will be given here.

(1) "Migration as a factor in Pest Outbreaks" was the subject of a paper by Mr. T. Bainbrigge Fletcher, Imperial Entomologist of of India. Mr. Fletcher said that while fluctutations of insect abundance in regions could frequently be ascribed to factors such as parasitic control or climate, it sometimes happened that outbreaks of insects occurred that could not be the result of abnormal local breeding and must be attributed to migrations from other localities. In India they found an accumulation of cases for which such an explanation seemed the only one possible.

(2) Mr. A. Gibson, Dominion Entomologist of Canada, read a paper on "Entomological Organisation in Canada" and gave a general account of the organisation of the Entomological Branch of the Department of Agriculture of the Dominion of Canada. The organisation is now comprised of five Divisions, namely, Administrative, Field Crops and Garden Insects, Forest Insects, Foreign Pests Suppression, and Systematic Entomology. An important feature of the Branch was the establishment of permanent research laboratories in the several provinces. The Canadian organisation was modelled on that of Washington. With regard to the Canadian budget for entomological services he explained that the money was spent on research and not on the actual carrying out of control measures. A number of lantern slides were shown illustrating various types of laboratories, insectaries, etc., as well as control work against pests causing serious damage.

COTTON.

(3) Mr. H. H. King, Government Entomologist to the Sudan Government, read a paper on "Methods of dealing with Cotton Pests in the Sudan." He gave an account of the measures which the Sudan Government had drawn up with regard to the cotton pests in that country.

(4) Mr. A. W. J. Pomeroy, Government Entomologist, Nigeria, read a paper on "Cotton Pests in Nigeria, with a preliminary discussion of the Status of Economic Entomologists in Government Service" which was followed by a discussion by several delegates.

SILK.

(5) The delegates of the Imperial Entomological Conference attended a meeting of the

Imperial Institute Advisory Committee on Silk Production on the 11th June.

Sir Frank Warner, who presided at this meeting, referred to the position of the world's silk trade and pointed out that the total quantity of raw silk entering commerce was about 70,000,000 ℔ a year. By far the greater part of this production came from Japan and China, and the bulk of the remainder from Europe and Asia Minor. Supplies within the Empire were negligible and only two British Colonies produced silk in commercial quantities, namely, India and Cyprus. There is a steadily increasing demand for raw silk by manufacturers, especially in the United States, which country consumes about 75 per cent. of the world's crop although not producing any raw silk itself. The production of silk was not keeping abreast of the increasing demand.

Professor Lefroy pointed out that there were other conditions besides suitable climatic conditions and an abundance of the mulberry plant that must be taken into consideration in the starting of a silk industry in any particular country. The abundance of cheap labour was an important factor, and until the cocoons could be reeled locally the heavy freight charges that would have to be paid on the cocoons was also important.

(6) Among the papers read and discussed at the conference were "The Aims and Organisation of Economic Entomology" by Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, and "Entomological Organisation in Egypt," by Mr. C. B. Williams, Entomologist to the Egyptian Government.

(*a*) Dr. Marshall's paper was of especial interest in that he brought out several points bearing upon the duties of Government Entomologists, and the function of departments under their control. He pointed out that "The concentration of entomological work in "the hands of a comparatively small Gov-"ernment department had undoubted ad-"vantages in the early stages of a country, "but it also presented some undesirable fea-"tures. In the first place it tended to create "in the minds of the farmers and planters the "idea that an entomologist is merely a person "who can be called in to assist in coping with "insects when they have become so numer-"ous as to cause serious damage to their "crops; in other words that the functions of "the entomologist are merely curative. The "idea was radically unsound."

These observations apply very much to British Guiana, but one may add that the entomologist is here invariably called in when the pest has become uncontrollable, and even then if the position is not too hopeless for him to suggest measures of control and he advises a treatment, little or no attempt is made to carry it out.

Dr. Marshall went on to say that "The most "important function of the Government En-"tomologist was research, but the cost of the "application to any given crop of the know-"ledge thus acquired should fall on the "growers themselves; and if it was found "necessary that the work should be done by "official entomologists then it should be "charged for, and in this way an efficient "self-supporting service might gradually be "built up."

(*b*) Mr. C. B. Williams, in his paper "Organisation of Entomology in Egypt" gave details of the present organisation of the Entomological Section of the Ministry of Agriculture of Egypt. The section, which was started in 1911, has developed into a very large organisation and is divided into two main sections, Research and Administrative. It not only investigates and advises on the control of pests, but also carries out for itself control measures that in most other countries are done by private individuals or companies. The total annual expenditure on the section is nearly £100,000, but of this about £40,000 is recovered in fees for the fumigation of citrus trees to kill scale insects.

At the final meeting of the conference held on the 18th June, the following resolutions were unanimously adopted :—

(1) The Conference wish to place on record their appreciation of the work of the Imperial Bureau of Entomology.

(2) The Conference, recognising the value of the interchange of ideas between entomologists from all parts of the Empire, endorse the resolution passed at the Conference held in June, 1920, that similar Conferences should be held in London every five years, and trust that steps may be taken for the summoning of the 3rd Imperial Entomological Conference in the summer of 1930.

(3) The Conference recommend that from time to time, as circumstances may render practicable, meetings should be held in each of the Dominions and Colonies of the entomologists, mycologists, and other scientific officers for joint discussion of their problems, and that

this principle should be extended to include meetings at some convenient central place of Dominion and Colonial entomologists, mycologists, and other scientific officers who are working in countries which are associated geographically or otherwise.

(4) Having regard to the ever-growing importance of economic entomology, the Conference urge that the fullest consideration should be given throughout the Empire to the provision of funds to allow of such expansion of the work of the official entomologists as may be found desirable.

At the same time they strongly support the view that large planting companies, or groups of planters and farmers, should, in their own interest, follow the practice already adopted in certain instances with satisfactory results, of engaging the permanent services of entomologists who can keep watch over the crops on the plantations or farms concerned with a view to their protection against insect pests.

(5) The Conference recommend that the annual revenue of the Bureau for the period 1926 to 1930 inclusive should be not less than £13,000.

(6) The Conference recommend that contributions amounting to approximately £11,600 per annum from the Imperial Government, the Dominions, self-governing Colonies, and Colonies not possessing responsible government should be continued at the same rates as for the current financial year, subject to such adjustment between the contributions paid by Colonies not possessing responsible Government as the Secretary of State for the Colonies may think desirable.

(7) The Conference are glad to learn that the Government of India has decided to make a contribution of £300 to the Bureau for the current financial year; but having regard to amounts contributed by other Governments and in view of the value of the Bureau to India, they express the hope that India as a whole will see its way to contribute at the rate of £1,000 per annum from 1926 inclusive, that being the amount contemplated when the rates of contribution from other Governments were fixed after the Conference held in 1920.

(8) The Conference express their satisfaction that official representatives of the Governments of the Irish Free State and of Northern Ireland have taken part in their deliberations, and they hope that these two Governments will in future contribute to the Bureau.

(9) The Conference approve the estimate of average annual expenditure on normal services for the period 1926 to 1930 inclusive, as presented in the report of the Director of the Bureau, amounting to £12,200 on the assumption that the necessary funds will be available.

(10) The Conference accept the principle that the Bureau should arrange for the export to Overseas Governments of beneficial parasites and they approve the estimate of £1,440 per annum for this work, as presented in the report of the Director of the Bureau, making an estimated average annual expenditure of £13,640 in all.

It is understood that if the annual contributions amount to £13,000 the annual expenditure in excess of that sum can be met for the next five years from the surplus funds which the Bureau has accumulated ; but should the Bureau be requested to undertake the supply of a parasite which involves investigations of a costly nature it should be open to the Director to represent to the Government concerned that the work cannot be undertaken without an additional grant for the purpose.

(11) While leaving the matter to the discretion of Managing Commitete of the Bureau the Conference consider that in present circumstances it would be inadvisable to increase the price of the publications issued by the Bureau.

(12) The Conference approve the arrangements made by the Director of the Bureau for the preparation and publication of the "Insecta" portion of the "Zoological Record" and recommend that this should be continued.

(13) The Conference do not recommend that steps should be taken to prepare a new edition of the Abstract of Plant Pest Legislation in the Empire, but they are of opinion that abstracts of the new legislation on this subject should be published as hitherto in the "Review of Applied Entomology."

(14) The Conference consider that the preparation of a comprehensive index to Series A of the "Review of Applied Entomology" is desirable, but regret that for financial reasons it does not appear to be practicable to proceed with the preparation at the present time. The Conference hope, however, that it will eventually be found possible to undertake this work.

(15) The Conference recommend that at the end of each financial year all the contribut-

ing Governments should receive a statement showing the work accomplished by the Bureau during the year.

(16) While recognising that in existing circumstances and with the funds at present at the disposal of the Bureau such a proposal may not be practicable, the Conference record the opinion that it would be of the greatest assistance if arrangements could be made for a Senior Officer of the Bureau to visit at request the Government Entomologists overseas.

(17) The Conference are glad to learn that proposals have been made for the despatch of an International Scientific Mission to Uganda, under the direction of Dr. H. Lyndhurst Duke, for further research in connection with testse-flies and human trypanosomiasis, but they strongly urge that arrangements should be made for comprehensive mearures against testse (both in the direction of immediate practical work and further scientific research) in the British dependencies in Tropical Africa on the lines contemplated in the Report of the East Africa Commission.

(18) The Conference, whilst gratefully acknowledging the invariably courteous and ready assistance afforded to entomologists by the Entomological Staff of the British Museum (Natural History), desire to draw the attention of the Trustees of the Museum to the paucity of the staff employed at the Museum on this subject, and also to the scanty accommodation, due to the present overcrowding state of the Insect Room, available for entomologists who wish to work at the Museum. In view of the vast and constantly increasing importance to the Empire

of a thorough knowledge of insects which occur both in the British Empire and in foreign countries, and to the vital necessity for the proper progress of work in Applied Entomology, of a corresponding progress in Systematic Entomology, the Conference desire to urge on the Trustees the necessity for an increase in the permanent staff employed in the Entomological Department of the Museum and in the accommodation available therein.

(19) The Delegates to this Conference desire to record their sincere thanks to the Chairman, Earl Buxton, to the Honorary Committee of Management, the Director and the Assistant Director of the Bureau for the excellent programme which they have provided for the Conference, and also to Sir Arthur Shipley, Professor Stanley Gardiner and Dr. Hugh Scott, of Cambridge University, to Professor Poulton and Dr. Dixey, of Oxford University, to Sir John Russell, Dr. Davidson, and the other members of the staff of the Rothamsted Experimental Station, and to Mr. J. C. Fryer and his colleagues at the Pathological Laboratory of the Ministry of Agriculture, for the instructive visits which they arranged.

II.—VISITS TO ROTHAMSTED EXPERIMENT STATION.

Rothamsted Experiment Station was visited on two occasions, first with the delegates of the Imperial Entomological Conference, and again with the Colonial Agricultural Officers. On both occasions both the field plots and laboratories were visited.

The parties were conducted around several of the field plots, and the work in progress explained. Perhaps the most interesting of these was the well-known Broad Walk Field, This field was among the original fields laid out by Lawes and Gilbert in 1843, and has since that time been continuously under wheat. The application of different manures on this land has been studied now for a number of years, and the data thus obtained has proved highly interesting and important.

In the course of the explanation a point brought out that may be of interest locally, is the possible substitution of muriate of ammonia (Ammonium chloride) for sulphate of ammonia as an artificial manure. There appears to be little or no difference in the action of these two substances in places where the rainfall is high, while price is in favour of the ammonium chloride.

The experience at Rothamsted is that muriate of ammonia is less effective than the sulphate for potatoes, but more effective for barley. The difference becomes less as the rainfall increases.

In the laboratories the investigations on insecticides being carried out by Mr. Tattersfield, on aphids by Dr. Davidson, and on soil insects by Mr. Morris, were explained by the workers themselves, as well as Dr. Keen's investigations with regard to the draw bar pull on ploughs, and Dr. Hutchinson's work on artificial farmyard manure.

Dr. Hutchinson was at the time carrying out investigations into the possibility of using the trash of sugar-cane for artificial manure, and this question was discussed with him.

The production of manure direct from straw is now being carried out on a large scale in England, and it is estimated that some 3,000 tons of straw and like material was treated in Great

Britain during the last season. The making of artificial farmyard manure is based on the fact that the organisms which produce the changes are naturally present either in the straw or in the dust, and only need suitable conditions to bring about the changes. These conditions are brought about by the addition of certain, easily obtained substances, especially nitrogen compounds, phosphates and calcium carbonate. Decomposition then rapidly takes place, converting the waste straw to valuable manure.

When one recollects the large amount of trash of the sugar cane and rice straw that are from year to year burnt in this Colony, it would appear to be a project well worth investigating.

Among the other interesting and important work that is being carried out at Rothamsted mention should be made of the work of the Statistical Department under Mr. R. A. Fisher. At the present time at Rothamsted wherever it is possible all field and laboratory observations are subject to the scrutiny of the Statistical Department with the view of obtaining as great as possible accuracy of results, and field data are examined in order to trace correlations between weather's crop growth, and other quantities measured. In order to do this it has been necessary to develop statistical methods to meet the particular work. The result of such examination has been the introduction of improvements in methods of experimentation, and at the present time a far higher degree of accuracy is obtained than was formerly the case.

In conclusion I would point out that the practical results of conferences such as these to workers in science, more or less isolated from the important centres of research as one is in this colony, are manifold, and perhaps can best be summarised in the following words from the letter of the Right Honourable Earl Buxton, Chairman of the Second Imperial Entomological Conference, to the Right Honourable L. S. Amery, Secretary of State for the Colonies, submitting the report of the Conference:—"The whole benefit to be derived from a "Conference of this nature is by no means "reflected in the Report of its proceedings. "Nothing is of greater value to men working "at the same subject under varying conditions "than that they should be able to meet one "another and discuss informally the problems "with which they are dealing; and these "Conferences furnish an unequal opportunity "for establishing personal touch of this kind."

THE CLIMATE OF BRITISH GUIANA.

ABSTRACT OF OBSERVATIONS—1846-1925.

By Sir John Harrison, C.M.G., late Director of Science and Agriculture.

As would be expected from the geographical position of British Guiana, the climate is warm, but on the whole a very healthy one. The usual range of temperature each year is from 65° to 91°. There is a long dry season from the middle of August to near the end of November, and a shorter, less sharply defined one in February, March and part of April; the remaining two periods are termed the short and long wet seasons respectively. But the long dry season is the only one of these that is sharply marked in every year, the short dry season not unfrequently turning out a very wet one, the short wet season is at times a period of more or less well-marked drought, while the long wet season may be of short duration.

For very many years, commencing in 1846 systematic meteorological observations have been made in Georgetown; the climatological records from 1882 onwards being very complete. A sub-station has been at work at the Penal Settlement, Mazaruni River, for over a quarter of a century. Observations of the more important climatological elements were taken for relatively short periods at two stations—Dada-nawa and at Eupukari on the Rupununi river savannah district.

Sir Robert Schomburgk, during his very extensive travels in the interior of the Colony between 1836 and 1843, made many observations at numerous places in the far interior, but, as he was constantly travelling, none of these covered any length of time.

The following abstracts of the observations at Georgetown are of interest:—

Meridian of longitude for calculation of time adopted as standard in the Colony ... 60° W.
Hours slow of Greenwich time ... 3° 45.

The meteorological station is situated in the Botanic Gardens, at a distance of 1.45 miles south of the coastline. The hours of observation are 7 a.m., and 1 and 6 p.m., local official time which is 3 hours and 45 minutes behind Greenwich time. The height of the cistern of the barometer is 6 feet 6 inches above the mean sea-level.

Temperature.—During the period 1846 to 1925 the mean temperature in the shade was 80.4° Fahr., the mean of the maximum temperature being 84.7°, and the mean of the minimum temperature 75°. The absolute maximum temperature recorded during the period was 92°, the minimum 68°; it is, however, a very rare occurrence for the maximum temperature in the shade to rise above 89°, or for the minimum to fall below 70°. The highest mean monthly temperature recorded in the shade was 89.3° in October, 1915, the lowest being 69.2° in September, 1850. The maximum sunshine radiation temperature (black bulb in vacuo) recorded on any day was 165°, whilst the minimum radiation temperature at night on grass was 60°, the highest mean monthly maximum being 152°, while the lowest mean monthly was 129.8°. The effect of the sunshine in raising the temperature of the earth is apparent to a depth of somewhat over 4 feet from the surface, at this depth the minimum monthly temperature during the year is 83°, whilst the maximum is 85°. The mean temperature of the earth from a depth of about 20 feet to 160 feet is 83° Fahr., below which depth the temperature slowly increases at the rate of approximately 1° Fahr. for each 90 feet increase in depth.

Rainfall of the Coastlands.—Fairly complete records of the rainfall of the lowlands of the colony exist from the year 1846 to the year 1925, with the exception of the period September, 1857, to March, 1863, the records of which have been lost or destroyed. The following are the average monthly records showing in addition the highest and the lowest rainfall recorded for each month with the year in which they occurred;—

Months		Rainfall.	Maximum Records.	Years.	Minimum Records.	Years.
January	... ...	7.82	20.77	1870	1.27	1901
February	... ...	5.54	16.55	1887	.55	1919
March	... ...	6.30	20.04	1907	.21	1873
April	... ...	6.71	20.59	1865	1.08	1867
May	... ...	12.58	22.23	1919	.40	1873
June	... ...	11.94	20.44	1849	1.87	1874
July	... ...	9.21	23.60	1863	2.47	1880
August	... ..	6.78	13.94	1857	1.78	1868
September	... ...	2.82	8.47	1876	.46	1888
October	... ...	2.68	9.99	1921	.03	1854
November	... ...	5.73	17.80	1897	.36	1884
December	... ...	11.43	26.16	1891	1.77	1881
Average Annual Rainfall	...	89.54	132.58	1893	44.93	1868

Rainfall of Georgetown.—During the 45 years period from 1880 to 1925 the rainfall at the Botanic Gardens, Georgetown, was 89 inches a year, the driest year being 1889 with a rainfall of 52.70 inches, and the wettest 1893 when the rainfall amounted to 135.24 inches. The average monthly rainfalls with the maximum and minimum rainfall recorded in any one month were as follows :—

		RAINFALL IN INCHES.		
Months.		Average.	Highest.	Lowest.
January	...	7.45	25.11	.92
February	...	5.80	20.72	.45
March	...	6.53	22.73	.28
April	...	6.41	20.11	1.12
May	...	10.81	23.38	1.20
June	...	11.46	24.38	5.14
July	...	9.89	19.38	2.81
August	...	6.36	14.76	1.84
September	...	3.66	7.56	.10
October	...	2.59	8.87	Nil.
November	...	6.03	20.74	...
December	...	12.01	32.38	1 35
		89.00		

Although the climate of Georgetown in common with that of the coastlands of British Guiana is regarded as a very wet one, excessively heavy rainfalls, such as are regarded as typical tropical rainfalls, are of somewhat rare occurrence. While the amount of rain which fall in each month of the year is subject to very great variations, the number of days of exceptionally heavy rainfall—over 5 inches falling in 24 hours—are very few. There have been only thirteen instances of rainfalls in excess of 5 inches in 24 hours during the long period 1880 to 1924, whilst the number of days in this period in which rainfalls have been in excess of 2 inches are shown in the following:—

Rainfall in 24 hours.	No of days in 45 years.	Approximate No· of days in 10 years·
Over 2 and under 3 ins. ...	205	45
„ 3 „ „ 4 „ ...	71	16
„ 4 „ „ 5 „ ...	16	4
Over 5 ins. ...	15	3

Ten of the rainfalls in excess of 5 inches in 24 hours were between 5 and 6 inches in quantity, 2 of them were between 6 and 7 inches, whilst one was somewhat in excess of 8 inches.

The climate of the coastlands of the county of Demerara may be regarded as characteristic of the whole coastlands of British Guiana, with the exception that the average annual rainfall in the eastern section of the coastlands is less than that of the middle or Demerara section, which in turn is less than that of the western or Essequibo section. The average annual rainfalls from 1880 to 1924 in these sections were as follows:—

	Inches.
County of Berbice ...	80.06
County of Demerara ...	92.86
County of Essequibo ...	102.41

As would be expected the range of variation in the amounts of rain falling in any one month is generally greater in Essequibo than in Demerara or in Berbice, with the exception of the month of June in which variations in the rainfall have ranged in the county of Demerara from 4.4 inches to 46.88 inches.

The frequencies of the rainfall in Georgetown are shown by our records from 1846 to 1921 to have been as follows:—

	Per Year.
Total rainy days	196
Under .10 inch	60
.10 to .50 inch	80
.50 to .1 inch	29
1 to 2 inches	20
Above 2 inches	7

The average yearly evaporation from a 6 feet square free water surface during the period of 10 years 1915 to 1925 was 58 inches, or approximately 65 per cent. of the total rainfall.

Velocity of the Wind.—The average velocity of the wind at an altitude of 60 feet above the ground is 7.16 miles per hour, the highest velocity noticed during the past 10 years having been 20 miles per hour during a two hour period, but at times, although not frequently, sudden gusts of wind occur with velocities somewhat in excess of 25 miles per hour. The prevailing direction of the wind is about N. 50° E.

Bright Sunshine.—During the past 35 years the average annual number of hours of bright sunshine as indicated by a Campbell-Stokes' Recorder has been 2443, cr approximately 6 hours 41 minutes per diem. The distribution of the daily hours of bright sunshine during the various months of the year were as follows:

	Mean.	Maximum.	Minimum.
January	6.0	8.5	3.9
February	6.8	10.0	3.7
March	6.5	9.5	3.3
April	6.6	9.7	4.2
May	6.3	9.5	2.9
June	5.8	8.0	2.4
July	7.1	9.0	4.2

	Mean.	Maximum.	Minimum.
August	7.8	9.7	5.8
September	8.4	9.8	6.7
October	7.8	9.6	[illegible]
November	7.2	9.8	
December	5.9	9.0	3.5

Atmospheric Pressure.—The range of the barometer on the coastland is slight. The average height is 29.900 inches or 1,122 milibars. There are, however, well-marked diurnal variations in pressure, the maximum pressure during the day being attained between 10 a.m., and noon, while during the night a lesser maximum is attained between 10 p.m., and midnight. The only definitely significant variation in the mean barometric height is just before the setting-in of the long periods of heavy rainfall when the barometer shows a very slow and slight, but continued, depression for 10 days to as much as a fortnight previously.

Atmospheric Humidity.—The percentage of complete atmospheric humidity varies from a maximum of about 86 per cent. at 6 a.m., to about 70 per cent. at 1 p.m., and to about 79 per cent. at 6 p.m.

New Amsterdam, Berbice; and Suddie, Essequibo.—Climatic observations at New Amsterdam, Berbice; and at Suddie, Essequibo, to the eastward and westward of Demerara, respectively, and at distances of about 5 miles from the coast-line in the estuaries of the Berbice and Essequibo rivers indicate that, while the mean shade temperature differs only slightly from that recorded at Georgetown, the range of the absolute maximum and minimum temperature is considerably greater, from about 66° as a minimum to 95° as a maximum.

Penal Settlement, Mazaruni River.—A sub-station has been at work at the Penal Settlement, Mazaruni River, in longitude 58° 38′ 45″ W. and latitude 6° 23′ 35″ N. at a distance of 42 miles south of the coast-line, for over 25 years. Here the mean temperature in the shade is somewhat less—about 2° Fahr. than that of Georgetown, the range of the absolute minimum and maximum temperatures being from 66° to 92°.

The annual rainfall at Mazaruni is, distinctly more than that of the coastland stations, having amounted during the last 25 years to 102.8 inches a year as compared with an average of 89.5 inches recorded on the various coastland stations. The number of days on which rain falls in each year at Mazaruni is as a rule greater than that at Georgetown, the number of such days being approximately 20% higher at the former than at the latter. Another well-marked difference in the climatology of Mazaruni and Georgetown is the lesser number of hours of bright sunshine recorded at the former place—an average of 5.4 hours per diem as compared with 7.2 hours during the same period of years.

South of the Penal Settlement.—Southwards of the latitnde of the Penal Settlement a well-marked increase in the amount of the total annual rainfall is noticeable, for instance at Tumatumari, Potaro river, where during the past 20 years, the average rainfall has been approximately 113.5 inches, and in the Mahdia valley, near the Eagle mountain range, where the average rainfall has been over 150 inches a year. Unfortunately no other reliable continuous records of rainfall exist in the far interior of the colony, but it is certain that the rainfall along the escarpment of the Kaieteurian sandstone is, as a rule, in excess of that recorded in the Mahdia valley.

Ruvununi Savannah.—Unfortunately it has not been feasible to establish climatic or meteorological stations in the far interior and in the high plateaus of British Guiana. Two stations were worked for relatively short periods of years at Eupukari and at Dadanawa in the Rupununi savannah district. At the former, 223 miles south of the coastlands, the average annual rainfall was 46.2 inches during a period of years when that of the coastlands generally was 87.8 inches, while at the latter, 280 miles from the coastlands, the rainfall was recorded at 58.5 inches during a relatively dry period of years on the coastlands when the average annual precipitation was 84.7 inches. The monthly distributions of the rainfall at the two stations were as follows:

		Eupukari.	Dadanawa
January	...	1.51	1.34
February	...	1.00	2.00
March	...	1.62	2,20
April	...	4.42	5.56
May	...	8.37	7.84
June	...	12.09	13.61
July	...	9.26	10.44
August	...	5.17	8.14
September	...	1.39	2.56
October	...	.39	1.65
November	...	.27	1 06
December	...	1.09	2.05

The mean temperature in the shade at Eupukari was 81.7°, the extremes noted being a maximum of 99° and a minimum of 66°. The average atmospheric humidity as percentage of saturation was 94.5 at 6 a.m., 74.1 at 1 p.m., and 76.3 at 6 p.m. At Dadanawa the mean shade temperature was 82.8, the maximum recorded in the shade being 103°, while the minimum was 66°.

SIR ROBERT SCHOMBURGK'S VIEWS ON THE CLIMATE OF BRITISH GUIANA.

Sir Robert Schomburgk during his residence in the Colony, and his travels in its far interior from 1836 to 1844, took numerous climatalogical observations, but these necessarily extended at any one place for a very restricted period of time, and therefore it is not feasible to draw any deductions from his published data. But in 1840 Sir Robert Schomburgk placed on record his views on the climate of British Guiana in the following terms:—

"Though Guiana is situated in the torrid zone, it "enjoys comparatively a more temperate climate than "other countries under the same latitude. The mean "temperature for the year is 81.2°, the maximum 90°, "the minimum 74°. It is generally considered that two "wet and two dry seasons constitute the changes during "the year. However regular the setting-in of these "periods may have been formerly, this has not been "the case during later years. The great dry season "commences at the coast region towards the end of "August, and continues to the end of November, after "which showers of rain follow to the end of January: "the short dry season commences in the middle of "February, and continues to the middle of April. The "rains descend afterward in torrents, and the rivers "commence to inundate their shores. During that "period the wind is frequently from the west and "south-west, and, coming from the land, is thought "unhealthier than the regular sea-breeze, which during "the dry season begin to set in between ten and eleven "a.m., and continues until sunset, sometimes even "through the night. The months of October and "November are the most delightful in the year; the "sky cloudless, the heat moderate, and the thermometer "at noontide scarcely higher than 85° Fahr. During "the rainy season the oppressive weight of the atmos- "phere is tempered by northern breezes, and in the "months of September to November the breezes from "the east and south-east, which have passed over a vast "extent of the ocean, are invigorating, and refresh the "air to such a degree, that during the night the ther- "mometer has been known to fall to 74° Fahr."

"The moisture necessary to maintain vegetation is "then replaced by dew; and not only in the interior, "where the country is not extensively cleared, but like- "wise in the open savannahs, the trees and plants will "be found in the morning dripping with dew."

"The change of the season is marked by severe "thunder-storms; but however loud the peals of thun- "der may reverberate, and however vivid the flashes of "lightning which precedes them, fatal accidents by "lightning are unknown in Guiana. Gales are scarcely "known, much less those terriffic phenomena of nature "hurricanes, which in the neighbouring islands destroy "in a brief time the fruits of many years' labour, causing devastation and loss of life to a vast extent."

"A few shocks of earthquakes are occasionally felt, "but they are so insignificant that the inhabitants "scarcely notice them when they occur."

"The temperature of the interior is still more mild, "and the climate healthy. The season in the interior "is only marked by two changes; from the month of "August to the month of March there are only "occasional showers, but from March to August the "rains descend in torrents, and the rivers commence to "swell and overflow their banks to a greater or lesser "extent according to their locality."

"The night is generally from 8° to 10° degrees "cooler than the day. A greater difference prevails "however at the table-land, from which Roraima rises "to a height of 7,000 feet; there I have known a "difference of 35° in the range of the thermometer, compared at the hours of five in the morning and two in "the afternoon. At this table-land, which was only "elevated about 3,000 feet above the sea, the thermometer half an hour before sunrise ranged between "59° and 62°, and rose between two and three o'clock "in the afternoon to 95° in the shade."

"The climate of British Guiana has been described "as unhealthy, and detrimental to European settlers; "consequently emigrants have rather preferred encountering the chilly blasts and severe winters of "Canada and the United States, or to subject themselves to horrors of a prolonged voyage to Australia, "there to suffer expatriation perhaps for ever from "their native homes and families, than to settle in a "colony where constant summer prevails, and which, "with the nigh establishment of regular steam-boats to "those parts, may be reached in sixteen or seventeen "days from England."

From a geological point of view it is to be regretted that the climatic records of the interior of the

Colony are so imperfect, for the weathering and lateritisation of its rocks are dependent on the amount and distribution of the rainfall and on the average temperature; whilst their splitting-up, detrition and degradation are largely dependent on the high temperature—150° Fahr. and over—which rocks in the tropics may attain when exposed to the full rays of the sun, and which high temperature may fall to 65° or even to 60°, by terrestrial radiation during the night.

PIGEONS.

By S. N. BRUCE, M.V.D., Veterinary Surgeon to the Municipality of Georgetown; Acting Government Veterinary Surgeon.

WHAT PIGEON RAISING MEANS.

The business of breeding pigeons offers generous profits, but both it and the birds must be well understood before it is gone into extensively. There is a false impression—unfortunately supported by misleading, unreliable advertisements—that any one can succeed with pigeons and quickly amass a handsome profit. Let no one take up the work with such an idea in mind, or he is likely to add his name to a long list of failures.

Start on a small scale, increasing as experience and returns warrant, be prepared to invest careful judgment, intelligent care, and plenty of work.

The pigeon industry has two branches, the breeding of squabs for human consumption, and the raising of breeding stock for sale. The first brings the surest and quickest returns, squabs being safely turned into cash at 4 to 6 weeks of age. The second requires more room for raising the young, also more care, more feed, more cleaning of the houses, and often involves more losses, but the advantage is better price for stock sold, if of good quality. Squabs bring from 48 cents to 96 cents per pair according to size, good mated breeders bring from $1.25 to $5.00 per pair according to the parent stock.

Select breeders with great care, there are lazy, worn out and worthless individuals in all breeds. Economize, if you must, on the number of pairs, never on the price of the birds, for cheap stock produces few and undesirable squabs, may breed disease and in many cases soon wears out. If possible be familiar with the different types and breeds, selecting thereafter from stock raised by reliable dealers. Buy in small quantities (5 to 10 pairs is enough at first) and only mated pairs. It is well to buy from several sources rather than one, in order to obtain different lines of breeding and insure healthy, vigorous young stock in the future. If possible insist on having "seamless banded" birds. These have a seamless metal ring attached when about two weeks old bearing a number and the year it is hatched. To do this hold the three front toes together and slip the band over them, holding the back toe up close to the leg until the band is slipped up over it. Open bands of metal, celluloid, etc., may be put on at any time and do not guarantee the bird's age. Two-years-old breeders are best, yearlings second best.

THE DIFFERENT BREEDS OF PIGEONS.

Of the many breeds and types of fancy Pigeons, the most popular are the Fantail, Pouter, Pigmy Pouter, Carrier, Jacobin, Archangel, Magpie, Nun, Swallow, Trumpeter, Barb, Turbit, Owl, and Trillback. Among the so-called sporting breeds are the Flying Homer, the Tumbler, the Tippler, and the Roller, Runts, Maltese Hens, Shaw Homers, Dragoons and Duchesse are bred as either fancy or utility stock found chiefly abroad.

Very few varieties of pure-bred stock are found locally. Here and there we may find a depleted stock of Flying Homers, Tumbler, Roller, Runts, and Maltese. Runt-Maltese crosses predominate locally.

BREEDS FOR TABLE.

There are varieties to suit all tables and the beginner should study the demand he is to supply before choosing his stock. If a six-pound-to-the-dozen squab is most suitable, select Homers, if an eight-pound-to-the-dozen, choose extra-large Homers, Maltese, or Runts.

Runt-Maltese crosses etc., are all good. The special advantages of cross-bred stock are uniform and increased size, vigor and tameness. Contrary to its name, the White Runt pigeon is the largest of all breeds.

HOUSING.

The site is as important as the building itself choose a high, dry spot with good drainage where the flying pens may be on the south or east side of the house. If one or two sound trees are in the way of the pen they need not be removed. Simply take off the lower branches and build around them ; the top will provide desirable shade.

The building—The design and size must depend on (a) the number of birds to be kept and (b) the taste of owner or the style of the surrounding buildings. For a small beginning, with probable growth in mind, a good pen is a simple shed roof affair 8 ft high in front, 6 in the rear, 15 x 15 feet in size. This makes a unit which may be added to as fast as necessary, a solid board partition being built between each 2 pens. A pen will hold 24 pairs of large breeders or 28 of small, providing the combination, grit, water and feed box is used and the floor space left entirely clear. If no stock is to be reared above squab size, or if it can be kept elsewhere, the adjoining nursery pen may be changed into a breeding pen by substituting nests for perches. A good plan for the beginner in such a case is to start with one breeding pen, use the second as a nursery the first year, then turn it into a breeding pen the next season.

GENERAL MANAGEMENT.

FEEDING—Feed pigeons twice a day, as early as possible in the morning and 3 or 4 o'clock p.m. Give only as much as they will clean up in half an hour, and if any is left over give less at the next feeding. Never feed on the floor, but on tables 2 ft high, which must be scraped clean of all dropping before each feeding if they are to be any better than the floor. All grains fed must be free from must, or mold. Musty, moldy, mousy feed will surely cause heavy losses of both old and young birds. Corn and split peas should not be stored in quantity as they have a tendency to heat and become moldy.

GRIT AND CHARCOAL—A generous, unfailing supply of sharp grit and charcoal is as necessary as feed.

SALT—Pigeons require salt but too much is more harmful than too little. A lump of rock salt placed in the centre of the grit box draws moisture from the air and gives the grit the slightly salty flavour that pigeons crave and no more. Never sprinkle it with water. Loose table and crushed rock salts are unsafe.

WATER—Give a fresh supply of water with each feeding in a vessel that can bekept thoroughly clean. A good plan that makes scalding unnecessary is to hang a clean paint brush near the drinking pan and each night wipe the sides and bottom of the pan with it, then rinse the vessel and leave it upside down to dry.

THE BATH—Pigeons are very fond of bathing and a large shallow pan should be kept in the flying pen. A galvanized iron vessel 2 feet square and 5 inches deep will generally serve. Empty it after the bath and turn it over so the dirty water will not be used for drinking.

CLEANING AND VERMIN—Clean the loft well once a week, scraping all exposed places with a three-cornered loft scraper or sharp hoe. After removing the manure dust slaked lime around; occasionally give the pens a good coat of whitewash. Body and feather lice and mites pray upon pigeons kept in filthy quarters and denied a frequent bath. Squabs are sometimes actually "eaten alive" and old birds so worried they are unable to sit on eggs or young. To prevent this dust the birds with a good insect powder twice a year by hand: and keep the pans clean and the nest disinfected with kerosene, turpentine, diluted crude carbolic acid, or a few moth balls.

DISTINGUISHING SEX—The male may be distinguished from the female by its larger, coarser appearance, thicker neck, and coarser head; it does the more and louder cooing and all the "driving." It is said that if a bird is held with its feet in one hand and the beak in the other and raises its tail, when suddenly stretched it is a female, but this test is not always infallible. The only way to be sure is to wait until the hen has laid.

MATING—Pigeons breed in pairs and any unmated bird of either sex in the breeding pen will greatly disturb the workers and cause considerable loss of eggs and squabs. The cock and hen selected for mating should be confined together in a small pen or in a double nest they are to occupy in the breeding pen for several days until thoroughly mated.

NESTING—When a pair is mated the cock bird drives the hen about the pen almost constantly, hardly allowing her to eat and drink. He is not satisfied until she returns to the nest, and keeps up the driving until the first egg is laid. Fine tobacco stems, straw, dried grass, or shavings may be placed within reach.

HATCHING—Pigeons lay 2 eggs before sitting, 2 days apart. The period of incubation is 18 days, during which the cock sits on the eggs from the middle of the forenoon until mid-afternoon, and the hen the rest of the time. For the first 4 or 5 days the tiny squabs live on "pigeon milk" a cream like substance that forms in the crops of both parents at the end of the hatch. The old bird takes the baby's beak gently into its own and pumps the soft feed slowly into the little mouth, After this milk is fed off, half digested grain is pumped into the squab and later whole grain with water and grit,

BANDING—Each squab that is to be raised for breeding should be banded when 2 weeks old with a seamless metal ring bearing a number and the year it is hatched.

DISEASES.

Disease among pigeons is more easily prevented than cured. The general causes are dampness, draughts, unclean or crowded quarters, moldy or too new feed, slimy drinking vessels, inbreeding, unhealthy parent stock and over feeding. It is not good to be continually giving drugs, though a good tonic may be given all the birds occasionally in the drinking water with good results.

A sick pigeon is easily recognised, it has a general appearance of misery, standing around in a huddled position, feverish, glassy-eyedand without appetite. It should be immediately removed from the pen and carefully examined for the following diseases:

ROUP—an extremely contagious disease of the nose and throat, caused by insanitary quarters, dampness, bad ventilation.

Symptoms—watery and swollen eyes, running at the nose.

Treatment—remove to a warm dry place apart from the flock. Give a pinch of epsom salts daily. Feed a light diet, with a few crystals of potassium permanganate in the drinking water.

CHOLERA—a dangerous disease that often destroys a whole flock in a short time, caused by filthy drinking vessels, moldy feed, new unseasoned corn, etc.

Symptoms—severe diarrhoea; emaciation.

Treatment—remove and give daily 3 drops of "hot drops" such as Jamaica Ginger on a piece of charcoal as big as a grain of corn; feed lightly.

WORMS.—Squabs or old birds that eat heartily but are very thin have intestinal worms.

Treatment—feed lightly and give a pinch of worm seed twice daily for 2 days then 5 drops of castor oil.

GOING LIGHT.—A wasting away disease that resembles consumption occuring mostly among young birds, and caused by overfeeding and lack of exercise or foul water or feed.

Symptoms—high fever and severe chills, watery and mucous discharges; difficult breathing (*dyspnoea*); emaciation.

Treatment—this disease can be cured only in its earliest stages before inflammation of the lungs has set in. Give a No 2 capsule filled with phosphate of soda each morning for 3 days, diet lightly.

CANKER an incurable hereditary disease much dreaded by pigeon fanciers.

Cause—tainted stock transmits it through the egg.

Symptoms—external and internal growths of solid yellow matter streaked with blood, appear commonly in the ear, throat, head near the eye, etc.

Treatment—birds may be cured to all outward appearance but sooner or later it appears again. The best, plan is to kill all birds that are known to breed cankered young or that show canker and thus stamp out the disease for once and all.

DIPHTHERIA,—a disease of the throat often mistaken for canker, attacking 2 or 3 weeks old squabs and caused by sudden changes of weather, heat and dampness.

Symptoms—throat and neck are red and much swollen, causing difficult breathing (*dyspnoea*); thick, yellow discharge from mouth.

Treatment—bad cases cannot be cured but light cases may be by swabbing out the throat several times daily with cotton dipped in witch hazel. Stubborn patches may be removed by dusting with baking soda and swabbing them off after a few minutes. Disinfect the drinking water by adding enough potassium permanganate crystals to turn it a bright rose red.

SQUAB TONIC.—A half ounce of copperas, 4 ounces of sulphate of soda ½ ounce powdered gentian, 2 ounces of phosphate of soda, 1 drahcm of pure creosote (beechwood). Thoroughly mix the creosote in a mortar with 40 grains calcinated magnesia, so that it will mix with water; pour into a gallon jug, add 2 quarts warm water, then the other ingredients, and mix thoroughly by rocking the jug. This will keep for years in a cool place but not in a metal container. Add one tablespoonful to a gallon of drinking water once a week.

THE CULTIVATION OF THE GROUND-NUT.

The following is an extract from an Article on The Cultivation, Preparation, and Utilization of the Ground-Nut in Vol. XXIII., No. 3 of the Bulletin of the Imperial Institute.—Editor.

EXTENT OF CULTIVATION.

The cultivation of the ground-nut extends over a very wide geographical area. The crop is successfully grown in most of the tropical and sub-tropical regions of the world, and also, to a certain extent, in countries where a temperate climate prevails. The ground-nut is used either locally as food, or as an article of export on account of the value of the seeds as a source of oil and of the residual cake as a feeding stuff.

THE GROUND-NUT PLANT

The ground-nut of commerce is known under several common names, such as pea-nut, goober-pea, earth-nut, monkey-nut, pindar Manila nut, Chinese nut, pistache de terre, Parachide, and in the vernaculars of India and other countries where it is grown, ·by translations of one or other of the names mentioned.

The plant which produces the ground-nut is known botanically as *Arachis hypogæa*, Linn. It is unknown in a wild state and its native country is a matter of some uncertainty. There is reason to believe, however, that it originated in tropical South America, as several species belonging to the genus Arachis are met with growing spontaneously in that country. Centuries of cultivation have probably so improved the plant that it is no longer comparable with the wild type, if this is still in existence.

The ground-nut plant is an annual herb belonging to the Papilionatæ division of the large family Leguminosæ, whose members are characterised by pea-shaped flowers. In general habit and appearance the plant resembles the clover. The leaves, however, differ from those of clover in having four instead of three leaflets These are arranged on the leaf-stalk in two pairs, and they exhibit at night the sleep-movement characteristic of the leaves of many leguminous plants. The stems attain a length of from 1 to 2, or 3 ft., according to the variety and the soil in which the plant is cultivated. There are several forms of it in cultivation, but in general two types may be recognised, the erect and the trailing. The varietal differences are chiefly in the shape of the mature pod, the number and colour of the seeds they contain and the manner in which the pods are produced on the stem of the plant. The flowers are bright yellow in colour and are of two kinds. Those that are borne above the leaves and are the most conspicuous are sterile and produce no pods. The fertile flowers are borne in the axils of the lower leaves in the erect-growing kinds, and all along the stem in the trailing varieties; they are smaller but more numerous than the sterile flowers and are almost entirely hidden by the foliage. When first produced, these flowers are sessile, that is to say they have no peduncle or flower-stalk; but the tubular calyx, which encloses the ovary, is often $\frac{3}{4}$ in. in length, and is sometimes mistaken for the flower-stalk. After fertilisation takes place the true peduncle develops, and continues to grow until it reaches a length of several inches. It takes a downward turn, and when it reaches the soil, it pushes the ovary several inches beneath it. In this position the ovary develops its seeds and in a few weeks the pod matures, forming the familiar ground-nut of commerce. If the stalk is prevented from penetrating the soil, no seeds are produced and no pod is formed. This peculiarity is of importance to the cultivator, as it indicates how essential for this crop is a fine surface tilth on the soil, which enables the delicate flower-stalk bearing the ovary to penetrate it easily. When mature, the pod may contain from one to as many as four seeds, according to the variety, but two is the usual number. The seeds are generally ovoid in shape with one end pointed and the other flattened, and are covered with a reddish-purple or yellow seed-coat.

In common with other leguminous plants, the roots of the ground-nut plant bear nodular growths. These are due to the action of bacteria which inhabi-them, and which have the power of fixing the free nitrogen of the atmosphere and rendering it available for the plant which serves as host. In consequence of this the ground-nut plant does not depend entirely upon the soil for the nitrogenous food it requires, and it is thus possible to cultivate ground-nuts on soils which are not particularly rich in nitrogenous constituents.

CULTIVATION

The ground-nut is not a difficult crop to cultivate provided the few essential conditions are forthcoming. The details of cultivation naturally differ in countries so widely seperarated as the regions mentioned above, but the following account gives the general procedure in most countries.

Climatic Conditions

In tropical countries the life cycle of the ground-nut plant is accomplished in from three to four months according to the variety. In more temperate regions some five to six months may elapse between the time of sowing the seed and the maturing of the fruit. It is apparent from a study of the geographical area over which the ground-nut is cultivated that it is possible to grow the crop under climatic conditions which differ considerably. In tropical regions there is always sufficient heat for this crop, and the only uncertain element is the rainfall; but the crop can be grown under irrigation, where the rainfall is scanty.

In tropical countries with well-defined wet and dry seasons the ground-nut crop is cultivated during the rains, and the whole of the vegetative growth is completed during the wet season. The sowing takes place as soon as the rains have sufficiently moistened the soil, and by the time the dry weather sets in the crop is mature and ready for harvesting.

Soil

The first condition required of a soil destined for the cultivation of ground-nuts is that it should have a fine surface tilth. The necessity for this arises from the peculiarity of the plant, already mentioned, in burying its fertilised ovaries beneath the soil in order to mature the seeds A fairly rich sandy loam appears to be the most suitable soil for the crop, and it is an advantage if it is light in colour as the pods are liable to be stained if grown in a dark-coloured soil. When required for sowing or for oil-pressing, the appearance of the pods is not of great importance, but when the seeds are to be used for edible purposes, light-coloured, clean pods fetch an enhanced price on the market. Abundance of lime is essential for the crop and where lime is lacking it should be added in the form of quicklime. The absence of lime from the soil is supposed to account for the production of "pops" or empty pods. A fair amount of humus or decayed vegetable matter is beneficial, but if too plentiful the haulm is liable to develop at the expense of pods. *Badly drained, sour, salt or clayey soils are unsuited to the crop*, but good yields have been obtained from stony soils rich in sand where a plentiful supply of sub-soil moisture is available.

Preparation of the Soil

If new country is being brought into cultivation it will be necessary to cut down trees, shrubs or undergrowth, should they exist, and these should be burnt on the land as the ashes form a valuable manure for ground-nuts. In countries where primitive methods of culture are practised the land is simply hoed by hand to a depth of from 2 to 4 in. In sandy soils the surface is left level, but in more compact soils it is thrown into ridges to afford better drainage. Where mechanical appliances are available the land is ploughed a short time before sowing if a previous crop has been taken off it; but if it is to be newly broken, the preliminary ploughing is carried out in autumn and is followed in spring by rolling and harrowing to break up the clods and render the surface smooth and friable. The depth of ploughing depends entirely on the character of the soil, but from 5 to 7 in. of loose soil is sufficient depth for the ground-nut. If the land is deeply cultivated the nuts are liable to be formed low down in the soil and this involves more labour for harvesting them, Where there is no manure to be turned in and the land is level and in a clean condition, the disk plough as used in the United States, is a useful machine for producing the fine surface tilth required by the crop.

It is advisable to cultivate the ground-nut as a rotation crop, as not only does this practice prevent the exhaustion of the soil, but the alternating crops are benefited by the good culture which the ground-nut demands and by the increased amount of nitrogenous matter contained in the soil as the result of having borne a leguminous crop. As, however, the whole plant, including the roots, is harvested, the soil does not benefit to the same extent as it does when a leguminous crop is ploughed in as manure. Local practice and demand will to a certain extent determine what plants to use as rotation crops with ground-nuts; amongst others that have proved suitable are maize, millet, sesamum, cotton, tobacco, and manioc (cassava) The alternation of other crops with the ground-nut has the further advantage of checking the attacks of insect pests which are liable to occur when the crop is grown on the same land for several years in succession.

Manures

Advantage should be taken of the rotation system of cropping to apply farmyard manure to the land, but if this is done the same year that a crop of ground-nuts is grown, the haulms are liable to make rank growth at the expense of the nuts. It is therefore advisable to manure the crop which immediately precedes the ground-nuts.

In addition to farmyard manure, artificial fertilisers may be used with advantage if the soil is poor, but care should be taken not to overdress the land or luxuriant top growth will be the only result. These fertilisers should contain from 1 to 4 per cent. of available nitrogen; 5 to 7 per cent. of phosphoric acid and from 6 to 10 per cent. of potash.

Wood-ashes which contain both lime and potash may be applied broadcast to the land at the rate of from 25 to 30 bushels per acre. Soils that are deficient in lime should receive dressings of fresh burned lime every four or five years at the rate of from 1,000 to 2,000 lb. per acre.

Sowing

Care should be taken to use only good seed for planting. With native cultivators it frequently happens that only the unsaleable nuts of poor quality are available, and to this is probably due the degenerate crops and poor yields which obtain in some localities.

In order to produce good results and to improve the crop, seeds should be saved from the best yielding plants and these should be grown in nurseries and carefully harvested for sowing in the field the following year. The nuts intended for seed should be fully matured on the plants and should be carefully picked by hand and stored in a dry place free from attacks by vermin.

Either the whole "nuts" or the decorticated seeds may be used for planting. If the former are used the germination of the seed is delayed until the shell has decayed and permitted the young plant to escape. This takes but a few days in tropical countries where decay is rapid, but in dryer and cooler regions the use of whole nuts for planting causes an appreciable delay in germination. The germination of whole nuts may, however, be accelerated by soaking them in cold water for about twenty-four hours and allowing them to drain for a few hours before planting. Another method of accelerating the germination of undecorticated seeds is simply to break the pods in two, leaving the seeds *in situ*. Where decorticated seeds are used the pods should be opened by hand and care taken not to injure the delicate seed-coat, as injury or bruises are liable to be followed by decay after the seed is planted. One of the advantages of shelled seed is the opportunity afforded during the shelling for eliminating any that are defective, hence the better "stands" that usual result when decorticated seeds are sown. The seed to be used for planting should not be shelled until a short time before it is required for use, as it is liable to lose its power of germination.

The seed is usually sown in straight rows or drills, an where hand-planting is practised the land should be first marked out. This is easily done by means of an improvised harrow with teeth set at the required distance. The seeds may be dropped in the lines made by the harrow at regular intervals and covered with soil by the foot. The depth at which the seeds should be planted varies from 1 to 1½ or 2 in., according to the character of soil. The heavier the soil, the shallower should be the planting. The distance between the rows depends upon the variety grown, and local conditions; and also as to whether hand or machine cultivation is to be employed. If the latter, the rows must of course be spaced sufficiently wide apart to admit of the working of the machine cultivator. A common distance for planting in the United States is 36 in. between the rows and 12 in. from plant to plant. If planted too thickly the branches of the trailing varieties overspread each other, and many of the stalks fail to reach the ground, and in consequence do not form pods; on the other hand the erect varieties, if planted too thinly, do not cover the ground and the crop is liable to suffer from drought in consequence. Experience of the local conditions and of the habit of the variety grown, is the only safe guide on this point, but not less than 1 ft. or more than 3 ft. between the rows should be given. Should serious gaps appear in the rows a supplementary sowing will be necessary, and this should be carried out as soon as possible after the plants from the first sowing appear above the ground; or seedlings may be transplanted to fill the gaps.

After-Treatment

At soon as the young plants have attained a height of from 1 to 2 in., the soil between them should be hoed. Where machines are available the horse-hoe or cultivator can be used for this purpose and much hand-labour saved thereby. Frequent hoeing is necessary, as this operation not only checks the growth of weeds and prevents the evaporation of moisture from the soil, but also produces the necessary fine surface tilth. The number of hoeings necessary will depend upon the character of the soil and the rate at which the weeds grow, but as soon as the haulms have developed sufficiently to cover the soils this work may cease. In making the later hoeings the soil should be drawn towards the plants, and this should be carefully done or the first-formed pods may be injured.

Harvesting the Crop

In tropical countries the stems begin to fade as soon as the rains have ceased and the dry weather has set in. This is an indication that the plants are ready for harvesting. It is advisable to lift the plants as soon as the stems show sign of fading, as then the pods are firmly attached to the stem and are not so liable to be detached during the process of lifting. Care must, however be taken to see that the maximum number of nuts are mature, as they ripen successively In the case of compact soils, which retain moisture for a considerable time, a longer period for ripening is required. The ripening season is a critical period, as if rain falls before the crop is lifted, after a spell of dry weather, the seeds in the first-formed pods are liable to start into growth, and are then of little or no value as oil-seeds. For this reason also, when the crop is grown under irrigation, the supply of water must be so managed that it is just sufficient to mature the crop, and it must not be continued after the first-formed nuts are mature.

There are various methods of harvesting the crop. Native cultivators either use a large hoe with which to lift the plants, or dig up with a fork.

The Chinese cultivator harvests his crop very thoroughly. He lifts each plant with a spade-like implement and throws it, together with the soil which adheres to the roots, into a bamboo sieve which is shaken by another operator. The soil passes throug the meshes of the sieve and the pods are retained. Any chance pods that escape are gleaned, or poultry and pigs are turned into the fields to feed on them.

Picking the "Nuts"

The separation of the pods from the stems is usually effected by hand, where the necessary labour is available. This is a tedious and expensive method, but, as it is not laborious, women and children engage in the operation. The pods should not be picked until they have become quite dry and the seeds firm and nutty, and empty or shrunken pods should be allowed to remain on the stems.

After being plucked or thrashed the pods should be spread out to dry and then put into sacks or stored in granaries protected from rain. In the tropics, where a long period of dry weather can be depended upon they are stored in large heaps before being shipped.

Yield

The yield varies with local conditions and the variety grown, and more especially with the amount of cultivation the plants receive. With proper methods of cultivation a good average yield is about 60 bushels per acre, though yields of 100 to 160 bushels per acre have been recorded.

Varieties

In nearly every country where ground-nuts have been cultivated for a long period of time, varieties peculiar to the locality have been produced. From this it would appear that by following a systematic course of seed-selection, it would be possible to obtain varieties suited to particular localities, to special soil or peculiar climatic conditions. Already much has been done to improve the yields in countries where they had detoriated by introducing new varieties or seed obtained from other localities. Where fungoid pests are prevalent it seems particularly advisable to follow this course, care being taken to obtain seed from sources known to be free from disease. Hitherto, very little appears to have been done, however, in the production of new varieties by breeding on modern genetic lines.

Pests and Diseases.

Although all parts of the ground-nut plants are liable to damage by insects, yet few pests appear to attack well-cultivated crops of ground-nuts when in the field. In West Africa the plants are liable to attack from a number of insect pests, but they are usually able to withstand such attacks if growing vigorously. In dry seasons, however, they may be affected by the drought and then more easily succumb to insect attack. It is important therefore, during a dry season, to keep the surface soil hoed in order to produce a dry mulch which prevents evaporation of soil moisture, and this, by keeping the plants more vigorous, tends to check the ravages of insect pests.

CULTIVATION OF GARLIC.

Land.—It should be grown as a garden crop, and succeeds best in a well-drained rich soil. This should be manured with well-rotted cattle dung and dug up to a depth of 4 to 6 inches. The land should then be well trampled down and reduced to a fairly fine tilth.

Sowing.—Plant bulbs 6 to 9 inches apart and cover with about 1 to 2 inches of soil. About 750 lbs. of bulb are required to plant an acre. Keep the land well weeded, and if the surface soil becomes hard, break it up gently with a small fork or stick. Water every three to four days if there is no rain.

Harvesting.—Crops take about four months to mature. They must, therefore, be planted so that they mature during dry weather. When the leaves begin to turn yellow the crop is ready to harvest. Crops should be lifted carefully, freed of earth, and then thoroughly dried in the sun. Yields of 2,000 to 3,000 lbs. of dried garlic per acre can be obtained.

F. A. STOCKDALE,
Director of Agriculture, Ceylon.

CULTIVATION OF ONIONS.

Land.—Onions grow best in a rich soil, but any land, if it is properly drained and well cultivated will grow onions. The land should be manured with well-rotted cattle dung and dug up to a depth of 4 to 6 inches.

Sowing.—Onions can be grown from seeds or from bulbs. In general it is safer in Ceylon to grow onions from bulbs, as seed does not grow well unless it is quite fresh, and beds of seedlings may easily be destroyed by heavy rains. When seed is used, the seed beds must be very carefully prepared and the soil reduced to a fine tilth. The seed beds must be trampled down before sowing as an essential to success in onion growing is that the seed bed should be firm. About 15 lb. of seed is required per acre. The seed sshould be sown in drills 6 to 9 inches apart, and the seedlings thinned out as they grow to about 6 to 9 inches apart. Seedlings thus. thinned out may be transplanted.

If bulbs are used, these should be planted 6 to 9 inches apart and covered by about 1 to 2 inches of soil About 750 to 1,000 lb. of bulbs are required per acre and therefore this method is expensive.

Cultivation.—Onions should be kept free of weeds and must be watered every three to four days if it does not rain.

Harvesting.—Crops take three months from bulbs and four months from seed. If they are being grown for drying, they must, therefore, be planted so that they mature during dry weather. When the leaves begin to turn yellow the crop is ready to harvest. Onions should be lifted carefully, freed of earth and roots, and then well dried in the sun. If they are not properly dried before they are stored, they will rapidly rot. Yields of 4,000 to 8,000 lb. Of dried onions per acre are common, and in planting from bulbs five to eight-fold can be secured. Heavy yields are only obtained if the land is well cultivated and manured.

F. A. STOCKDALE,
Director of Agriculture, Ceylon.

KEEPING QUALITIES OF RIPE MANGOES.

The following Report by Mr. A. W. Bartlett, B.A., a former Government Botanist, on the keeping qualities of mangoes was published in Vol. II No. 2 of this Journal and is reprinted at the request of the Board of Agriculture.—Editor.

1. The experiment has been carried out with 260 mangoes belonging to 23 varieties picked at various dates between the 7th February and the middle of March

2. A tabulated statement of results is herewith submitted.

3. In all cases the mangoes were gathered in pairs, each pair at the same time. One was immersed in a 3 per cent. solution of formalin for ten minutes, the other merely kept as a control under exactly similar conditions. They were examined daily, and the dates when they became soft or rotten or mildewed noted.

4. Contrary to similar trials made with formalin on soft-skinned fruits the use of formalin was found to lessen instead of increasing the average number of days which elapsed before the mangoes became more or less unfit for eating, except with 3 varieties. Every care was used in handling the mangoes during the treatment with formalin to avoid bruising them and so hastening their decay.

5. One important fact that these experiments have shown is that, without any special precaution beyond care in picking and handling, most varieties of grafted mangoes will keep on an average for about 10 or 12 days, even in our climate. In cool storage it is likely that their keeping powers will be much increased.

6. During the earlier trials it was found that decay usually originated at the stalk end of the fruit, although the stalk had not been broken off. In gathering the fruit it must not be pulled, but the stalk must be cut,

because the pull required to break the stalk is sufficient to bruise the stalk-end of the fruit and cause decay to set in earlier at this place.

Tabulated Statement of Results.

VARIETY.	No. Tried	Average No. of days the Fruits kept		Average No. of days increase or decrease in keeping powers due to Formalin	Longest No. of days any Fruit kept	
		Treated with 3 o/o Formalin	Untreated		Treated with 3 per cent. Formulin	Untreated
1. Dare	20	7·8	9·8	—2	12	13
2. D'Or	18	9·3	11·1	—1.8	12	15
3. Ceylon	6	7·7	10·7	—3	8	13
4. Jamaica No. 11 ...	20	10·3	11·6	—1·3	14	16
5. Josephine	4	11·	14·	—3	13	17
6. Seedling Madame ...	16	12·	12·	0	15	14
7. No. 2 Canal... ...	26	10·8	11·9	—1.1	16	16
8. Madame	32	12·2	13.9	—1·7	17	19
9. Chinoise	10	5·8	11·2	—5·4	8	15
10. Bombay 25	20	10·4	13·	—2·6	15	16
11. Peters	4	7·5	9·	—1·5	9	10
12. Martin	6	8·	6·3	—1·7	11	9
13. Bangalore	16	12·6	11·9	— ·7	19	14
14. Divine	4	9·	10·5	—1·5	10	12
15. Mrs. Francis ..	4	12·5	10·5	2	13	11
16. Peach	4	12·	17·	—5	14	20
17. Mrs. White	6	11·3	15·3	—4	14	17
18. Bombay 26	10	9·2	12·4	—3.2	12	15
19. Bombay 22	2	..	...	...	15	17
20. E. I. Seedling ...	4	12·	12·5	— ·5	12	14
21. Kerschapotte ...	12	9·3	10·5	—2·2	14	14
22. Crassous	10	11·6	12·8	—1·2	14	15
23. Bombay 27	6	10·	13·6	—3·6	11	15

FEEDING COTTON-SEED PRODUCTS TO FARM STOCK.

Practical experience has been supplemented by carefully conducted experiments, both in the United States of America and Europe, with cotton seed, cotton seed hulls, and cotton seed meal as food for cattle, sheep, pigs, horses, and mules with the result of demonstrating their high feeding value for all kinds of farm stock, with the possible exception of calves and pigs, to which they have frequently proved fatal.

The high feeding value of whole cotton seed has long been recognised, having been fed raw, roasted, steamed, or boiled to live stock, especially cattle. Almost from the beginning of cotton culture in this country it has been used to some extent as a feeding stuff, but since the introduction of the cotton-seed oil industry, the superior feeding quality of the by-product—cotton-seed meal—has led to a very general displacement of whole seed by the meal in localities where the latter is easily and cheaply obtained.

The value of cotton-seed meal for producing meat, milk, and butter is well established. It is one of the cheapest of the highly nitrogenous feeding stuffs and is therefore one of the most economical for balancing rations deficient in protein, such as those in which corn is the principal grain.

Although milch cows will do well for an indefinite period on cotton seed or cotton-seed meal as the sole grain food, it is better to add a second, such as corn meal or wheat bran to the ration. If fed to cows in large amounts without proper admixture of other feeding stuffs it is likely to injure the quality of the butter as regards flavour and colour. It appears, however, to harden the butter and thus to enable it to stand shipment better. It has also been found to facilitate very materially the rise of cream by gravity.

A reference to the analysis of cotton-seed hulls and meal will show that neither of them is adapted for use alone as food. The hulls contain a large excess of non-nitrogenous matter and the meal a large excess of protein; each lacks what the other has in abundance. The meal is well adapted by its composition to be fed with the hulls, and the hulls find their proper supplement in the meal. The relation is so evident that the fact that it is was not pointed out much sooner is peculiar, although the uninviting character of the hulls as food doubtless had the effect of diverting both scientific and practical investigations from them.

The above combined results are obtained by the use of undecorticated cotton-seed meal.

—U.S. Dept. of Agriculture,
Farmers' Bulletin No. 36.

WOOD FINISHING

BY

WILLIS T. POPE.

For some years I have been considerably interested in wood finishing, particularly that part which involves staining, filling and polishing. It is a great field of work, ever attractive and pleasing, to investigate. New matter and different results are constantly presenting themselves. Though wood finishing is one of the very oldest arts, and one that requires much knowledge of materials, as a craft we find little literature regarding it.

Good instruction in iron work and wood work can be procured easily in almost any of our industrial and manual training schools, but, as a rule, very few lessons are given in the finishing processes that go to make an attractive piece of wood work, whether it be a piece of furniture or the interior of a dwelling. As a people, we depend almost entirely upon untrained workmen for our information. Good polishers very seldom know much about materials and their sources. They have little information to give away, and the secret of their success, when found out, is about the same old receipt made good by hard rubbing.

In discussing briefly the subject of wood finishing, I will no doubt dwell upon particulars of which you are more or less familiar, but I trust the interest will be worth the short while taken.

No two species of trees produce wood, of exactly the same structure. There is a great variation in woods of the same species, in fact a distinct study in each separate piece.

Examine almost any piece of wood, and in a general way we find it composed of small cells of various kinds, usually long and tubular, running lengthwise, and adhering to each other more or less strongly. These cells have had special uses in the life of the tree, some were for conducting crude sap from the roots to the crown, others acting as storehouses for digested plant food, and still others have long acted merely for strengthening the tree and holding it together. Investigation shows that some of the cells have thick walls and small openings, others, thin walls and large openings. Most specimens of wood have these different kinds of cells arranged or grouped together in such a way as to form the *annular rings* which are so distinct on the cross section of most lumber and give the beautiful watered grain to longitudinal sections.

When the growth of the trees begins in the spring or at the beginning of the wet season in most tropical countries, there is a great demand for water in the crown where the multitudes of new leaves and twigs are forming, hence a new layer of large, loose thin-walled cells is rapidly built; when the demand for crude sap is not so great, and when there is plenty of digested food to supply building material, the cells formed are narrow and thick walled, thus the latter growth of each season is heavier, stronger and darker in colour than the earlier growth. As long as the tree is in good condition, distinct rings are left, one for each year, which the foresters and lumbermen make use of in determining the age of trees of the forest. Fire or insects or anything of the kind damaging one side of the tree will often be the cause of incomplete annular rings. Seasons of drought leave narrow and indistinct rings that prove correct records of those dry years throughout the existence of the trees. These accurate records were very valuable to the parties who determined the great age of the grand Sequoias of California.

Other markings, peculiar and interesting, and that have much to do with the finishing of the species of wood, are the dappels of thin plates of cells belonging to the *Medullary rays.* These lines of cells run from the pith in the centre to the bark as longitudinal layers. Their function is to strengthen and bind the annual layers. Though, they are present in most tree stems, they seldom appear more than as faint lines radiating from the centre of cross sections. In oak they are very conspicuous and add great value to it. To get oak boards well marked with these medullary rays, the logs are cut into quarters, each quarter being ripped up into boards with their cutting plane oblique to the quartering cuts (or as near as possible along the lines of rays). This brings the surfaces of the boards nearer to the radiating medullary rays of the logs, thus giving many of the dapples on each surface. This quarter cutting greatly increases the cost of the lumber because of the waste, but at the same time increases its strength and enhances its beauty. Trees of the forest that yield the most handsome lumber with a beautiful and well marked finish are those which have plenty of room for growth, which are exposed to winds that cause them to bend and toss, and which have ample light and space for development.

The composition of wood is of importance to the wood finisher. It is briefly but well explained in "A Primer of Forestry." Bulletin No. 24 of the Division of Forestry, U. S. Department of Agriculture.

"Wood is made up chiefly of carbon, oxygen and hydrogen. When perfectly dry, about half its weight is carbon and half oxygen and hydrogen, in almost the same proportion as in water. It contains also about one part in one hundred by weight of earthy constituents. The nitrogen and water taken up by the roots were originally in the air before they reached the ground, it is true, therefore, that when wood is burned, those parts of it which come from the air go back into it in the form of gas, while those which come from the soil remain behind in the form of ashes."

The cell structure of most woods, as left by the smoothing tools of the workman, is so open that it is difficult to get a finished surface without using considerable expensive polish or varnish, which would have to be applied in thin coats with considerable time for each to become hard. This difficulty is overcome by the use of a *filler*; the name implies its object. A cheap, durable mixture is rubbed into the openings of the wood forming a body, or foundation upon which the finish is to be placed. Very hard, close grained wood, as olive, lignum vitæ and some species of eucalyptus, do not need the filler.

Wood filler for many kinds of woods may be purchased ready for use. Cheap varnish is sometimes used as a filler, and shellac cut with alcohol makes one of the best for work where the pores are not too large. Large cracks may be filled with a composition consisting of rosin and beeswax. Two applications of filler, if well applied, are usually satisfactory for any kind of finish. (The second coat should not be put on until about 36 or 48 hours after the first). Too much of a single coat is apt to shrink away into the wood. Equal parts of *Japan drier* and *boiled linseed oil* thoroughly mixed with a body of *corn starch* to form a thick putty-like paste, thinned down to the desired liquid with turpentine, makes a filler that is suitable for most woods, Instead of corn starch, some earthy material as plaster of paris, whiting or pumice stone is sometimes used, but the old reliable corn starch has proven satisfactory.

Just a few words as to those materials that form the filler. Japan or Japan drier is a brownish liquid having somewhat the nature of varnish, called a drier on account of its property in paints, etc., is made by cooking gum shellac with linseed oil: the mixture is cooked down to a very thick fluid and then thinned with turpentine. Shellac is the shell form of *lac*, a resinous gum produced on several kinds of trees by a species of scale insect in the East Indies.

Boiled linseed oil, as most of us know, is a product of the flax seed obtained by placing the crushed seeds under great pressure, and the extracted oil then boiled with litharge (sugar of lead) which leaves a liquid varying from light umber to dark yellow in colour, with the property of drying quickly when spread in a thin layer. The turpentine, of course, is the liquid obtained from the rosin of several species of pine trees.

Fillers are usually applied with a brush, sponge or piece of cloth. A few minutes after the application the work should be rubbed vigorously with another cloth or a piece of canvas, first crosswise and then lengthwise. It is not uncommon to add a little chrome yellow, yellow ocher, venetian red or burnt umber or some other colour to the filler, which often improves the appearance of the wood. In finishing carriages, piano and small articles, it is not uncommon for the workman to use polish, rubbing into the fresh application finely powdered pumice-stone, just a little at a time. The object of this is two-fold, for levelling down and giving an even under-surface and to work a durable mineral material into the pores.

The *staining* of woods may be considered for several purposes.

First, to preserve the wood; second, to stain common woods to imitate superior classes, as the staining of common oak to give it the appearance of antique oak or as golden oak; third, staining to add uniformity or colour throughout a piece of work. Wood of the finest quality, no matter how carefully selected, will be given some staining medium when it passes through the French polisher's hands, which he claims is done to bring out the beauty of the grain.

Staining has become very popular for house furnishings of late years on account of its cheapness and the fact that it does not destroy the natural beauty of the wood. It is less expensive to keep woodwork fresh and clean, when stained, than it would be to apply successive coats of paint and varnish.

Stain may be applied as an opaque coating on roofs and the exterior walls of houses, and again it may be applied as a thin wash, giving colour to some depth, but leaving visible the character of the wood.

Some years ago, wood finishers used a great many vegetable dyes for colouring wood, and when a dry pigment was applied water was usually the vehicle used to carry it into the wood, but turpentine, alcohol or an oil has been found to be better, as it does not raise the grain of the wood. If the liquid used as a vehicle to carry the colour pigment into the work is a good wood preservative, the stain will have double value, *i.e.*, to give colour and preserve. Boiled oil is highly recommended as such a liquid. A very good stain is composed of two parts of turpentine, one part of boiled linseed oil and a little Japan drier, these added to the colour pigment that is selected, venetian red, burnt sienna, vandyke brown or chrome green or some other colour. In such a stain the oil gums the pigment, the turpentine keeps it thin until deposited in the proper place and then evaporates, and the drier helps to set the mixture.

I am told that many stains are sold ready for use containing carbolinium, kerosene and various other oils that act as wood preservatives; denatured alcohol is also much used of late. Most of these are cheap and reliable. One gallon of liquid stain will cover about a hundred square feet, and after buying a few small sample bottles and finding a suitable one, you can usually rely upon getting a further supply to match. It is a good plan, and often saves much disappointment, if before staining, a few small pieces of wood are experimented with till the required result is obtained.

"Aniline" dyes may be usefully employed on wood for self-colours only—as distinct from various imitations of woods. Their introduction a few years ago, I am told, produced a disastrous effect on the old vegetable dye market, nevertheless many of the vegetable stains are exceedingly useful.

Logwood stain, made from boiling the chips of the logwood tree (*Haematoxylon*) is still a much used vegetable stain. This product is imported from Central America and the West Indies. We have a few specimens of these trees about Honolulu. It does well in most warm regions of the earth.

Other dye-woods worthy of mention are red sanders, orchella weed, safflower and nut-galls.

Many colouring materials are to be obtained from common plants. The well-known blueberry, when boiled down with a little alum and a solution of copperas (sulphate of copper) will develop an excellent blue colour; treated in the same manner with a solution of nut-galls, it produces a dark brown tint; with alum verdigris and sal-ammoniac, various shades of purple and red can be obtained from it. A good green stain is obtained from broom corn.

Stain is usually applied with a brush, sponge or cloth, and on surfaced work, where the grain of the wood is to show, the excess is wiped off with a cloth in a few minutes after the application.

After a piece of wood has been stained, it can be given one or more coats of white shellac, smoothed with fine sandpaper and varnished. Varnish is a viscid liquid, consisting of a solution of resinous matter in oil or a volatile liquid laid on work to give it a smooth hard surface with a gloss.

Manufacturers claim that varnish should be used just as it is sold. While it is true that it is a mistake to add anything to the finer grade of varnish, the poorer qualities are often too thick to work freely without diluting. If it is necessary, add turpentine until the varnish spreads freely with a brush. After varnishing, let it stand for at least 24 hours, by which time the coat will be hard. A coat of varnish over one that is not hard will often result in *sweating*, which will necessitate scraping the work and recommencing the job from the beginning. A good many have shellac for the first coat to fill the pores.

To apply varnish properly requires a good deal of practice, and it is impossible to lay down rules that shall govern the process. The inexperienced almost invariably applies too much varnish and the result is it cracks. Where several coats are given, rub each down with fine sandpaper after it dries so as to give a smooth well filled surface for the next.

Spirit varnishes consist of alcohol and a vegetable gum as gum sandarach, gum copal, gum mastic, or a combination of mixed gums.

Alcohol and gum shellac also make a good spirit varnish. More quickly drying varnishes are said to be made of the gum cut with ether.

Linseed oil is the principal oil used in the manufacture of oil varnish. This varnish has a tendency to settle in a more even layer after spreading, although it takes longer to dry.

A wax polish proves quite satisfactory on many kinds of wood. The ingredients are bees wax and turpentine with more or less rosin added to harden the surface, but many do not add the rosin at all. A good way to prepare the wax is to melt the beeswax, and before it has time to cool, add the turpentine. Caution is necessary as both the wax and the turpentine are very volatile. As in the stain, the turpentine is merely the vehicle which enables the wax to be easily applied. In a thin condition, it may be laid on evenly over the work with a stiff brush or rag. After the wax has been spread the polish is obtained by friction, and the more it is rubbed, the brighter it will be. This final rubbing should be done with a hard, dry piece of canvas.

For most good work, French polish is to be preferred to all other finishes, as finer results can be obtained by it. It differs from varnish in that the resinous material is applied with a rubber (a hard pad of cloth) instead of with a brush. To become a good polisher, skill and practice are necessary as well as knowledge of material.

Polish requires that the pores of the wood be properly filled in order to get the smooth surface, fillers are used much the same as for varnish. After the fillers have thoroughly hardened, the laying on of the polish, which is called "bodying in" is begun. The way in which this is done greatly affects the appearance and durability of the gloss. When the body is too thin the gloss soon fades on account of the material sinking into the wood, and when the body is too thick it gives the finish the appearance of varnish.

The rubber is made of long strips of cloth rolled tightly and bound with a string or rubber band; this is put into a double thickness of cloth, linen preferable, the ends of which are gathered up and tied. This form of a rubber is not very useful for moulding purpose. Old rubbers, if well taken care of, are better than new ones. They should be kept in an air-tight receptacle.

The process of applying the polish is somewhat as follows:—The wad is moistened with the polish and then covered with a cloth which is brought over the end smoothly, then rubbed briskly across the grain to let the surface fill, after which the work is gone over with a series of circular movements, applying a moderate pressure, increasing a little as the rubber dries. In order that the rubber may pass smoothly over the work, a drop of raw linseed oil is occasionally added to the face of the rubber. As the rubber dries, more polish is added as in the first instance. A little polish will go a long way, and at no time should there be anything like a flow from the rubber. The first *bodying in* should be continued until the wood will absorb no more, after which the rubber mark will still show but gradually disappear in the finish. The final operation in French polishing by which the gloss is put on to the body previously applied is known as spiriting off and it removes all kinds of marks. This process partakes very much of the nature of bodying in. It consists in washing the bodied surface with alcohol. The surface is gradually reduced to a fine gloss with all blemishes removed.

To make a good polish, take about six ounces of shellac and add one pint of wood alcohol; great exactness in proportion is not necessary. Shellac dissolves gradually and the process is hastened by shaking, but heat is not necessary. White polish is made with bleached shellac, common polish with orange shellac. Manufacturers of polish assert that in addition to shellac, certain gums improve the quality of the polish when properly used, but shellac is the principal ingredient in nearly all polishes. Gum benzoin and alcohol make a very good polish, but it is not generally used.—*Hawaiian Forester.*

Meteorological Data—January—March 1926.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evapo-ration.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1,00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
Jany. ...	1·93	4	7	...	...	...	11	5·27	85·4	74·8	80·1	76·6
Feb. ...	·85	6	1	...	...	...	7	5·49	85·8	75·3	80·5	74·2
March. ...	·56	3	1	...	...	...	4	7·06	86·5	76·1	81·3	69·2
Totals	3·34	13	9	...	...	...	22	17·82				
Means.	...	...	...	...	...	...	...	...	85·9	75·4	8·06	73·3
Berbice Gardens.												
Jany. ...	1·90	13	4	...	...	...	17	...	86.4	73·2	79.8	75·5
Feb. ...	·42	9	...	...	...	...	9	...	86·0	73·0	79·5	73·7
March. ...	·46	4	2	...	...	...	6	...	87·0	74·0	80·5	70·2
Totals	2·78	26	6	...	...	...	32	...				
Means.	...	...	...	...	...	...	...	...	86·5	73·4	79·9	73·1
Onderneeming.												
Jany. ...	2·39	...	6	2	...	...	8	...	87·0	73·0	80·0	...
Feb. ...	1·62	1	4	1	...	...	6	...	87·0	73·0	80·0	...
March. ...	·57	...	2	...	...	...	2	...	89·0	74·0	81·5	...
Totals	4·58	1	12	3	...	...	16	...				...
Means.	...	...	...	...	...	...	...	...	87·7	73·3	80·5	...
Morawhanna. N.W.D.												
Jany. ...	1·73	13	4	1	...	...	18	...	...	...		...
Feb. ...	2·24	2	8	1	...	...	11	...	...	...	...	...
March. ...	returns	not	yet	to	hand	...	...	...	...	...	... ...	...
Totals ...	3.97	15	12	2	...	...	29	...	...	...	...	...

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first quarter of 1926.

The corresponding figures for the same period during previous years and the average for the eight years previous to that are added for convenience of comparison.

Product.	*Average 1916-23.*	*1924.*	*1925.*	*1926.*
Sugar, tons ..	20,724	12,800	12,947	20,489
Rum, gallons ...	936,760	180,614	301,355	197,693
Molasses, gallons ...	22,036	31,394	16,717	170,124
Cattle-food (Molascuit) tons	463	175	458	266
Cacao, cwts. ...	11	None	None	None
Citrate of Lime, cwts.	20	None	None	None
Lime Juice, gals. ...	489	None	None	None
Essential Oil of Limes gals. ...	25	None	None	None
Coconuts, thousands	813	531	305	293
Coconut Oil, gals. ...	6,062	7,433	6,608	9,019
Copra, cwts. ...	520	5,237	4,159	16,169
Coffee, cwts. ...	1,898	2,290	1,779	4,882
Kola-nuts, cwts. ...	1	None	None	None
Rice, tons ...	3,351	1,239	2,324	1,534
Ricemeal, tons ...	14	None	None	None
Cattle, head ...	103	81	283	11
Hides, No. ...	1,329	2,501	3,119	2,553
Pigs, No. ...	88	122	361	122
Sheep, head ...	6	1	None	None
Balata, cwts. ...	2,252	3,670	2,887	3,902
Charcoal, bags ...	12,133	10,486	7,981	7,636
Firewood, Wallaba, etc., tons	2,029	1,996	1,901	1,792
Gums, lbs. ...	1,476	None	None	866
Lumber, ft ...	49,206	52,785	13,695	95,261
Railway sleepers, No.	3,625	4,790	20,613	3,425
Rubber, cwts. ...	35	3	None	74
Shingles, thousands	448	157	299	370
Timber, cub. ft. ...	28,170	48,204	49,604	71,922

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330
1925	3,317	2,755	1,580	1,819	470	1,663	1,597	13,201

JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XIX. JULY, 1926. No. 3.

THE PROPOSED GOVERNMENT FRUIT, VEGETABLES AND PRODUCTS DEPÔT.

In our January issue we strongly advocated the establishment of an Agricultural Loan Bank as a means of encouraging our farmers to extend their cultivation of fruit and vegetables, and so overcome the existing shortage of these commodities. Assuming that this is primarily an agricultural colony, it is a grave reflection that we are to a large extent dependent upon our neighbours for fruit and ground provisions; but it must be taken into consideration that our farmers have been greatly hampered and discouraged in the past by circumstances over which they had no control, such as droughts and floods, and in smaller measure, by attacks of plant pests and diseases. However, even with improved drainage, and the assistance given by the Department of Science and Agriculture in the teaching of modern methods of cultivation, the distribution of plants and seeds, and the control of pests and diseases, the fact remains that our farmers have been severely handicapped by lack of knowledge of marketing their produce, and hence in not receiving the full money value for their crops. We have ascertained that potatoes can be landed here more cheaply by schooners trading between Barbados and British Guiana than they can be produced and sold in the Georgetown Municipal Markets when grown by the local farmers. This being the case, it is evident that both transport difficulties and the absence of any organization linking up the small farmer with the consumer, are acting detrimentally against the farmer's interests. It is a fact which cannot be gainsaid, that such crops as plantains, ground provisions, kitchen garden produce, etc., pass through various hands before finally reaching the consumer, with the result that the latter has to pay the middleman's profit, the farmer does not benefit, and the middleman ekes out a parasitical existence at the expense of all concerned. Again it is well known that farmers have to suffer much inconvenience before they can dispose of their crops; some have to travel great distances with their produce with the object of selling it with advantage. In many instances this is not achieved, and the farmer returns home, out of pocket, and considerably disheartened.

The proposed establishment of a Fruit, Vegetable and Products Depôt in Georgetown is a step in the right direction, and when started, farmers and others should do their utmost to make it a success. There is no reason why such an agency should clash with the legitimate commission agent. Indeed, the Government Depôt, it is hoped, will act as a stimulus to greater production and a larger volume of trade, which, in time, may lead to certain products being found on our export list, which at present are conspicuous by their absence. The main idea is to supply a ready and perfectly reliable market for the small farmer and to link up the Georgetown consumer with the grower. Much fruit goes to waste in our country districts —oranges, pineapples, bananas and such like crops. As Mr. Charles Shankland states, small trial shipments of these and other products might yield really valuable information as to "the quality of the goods shipped transport arrangements, packing, demand, selling values, markets etc." Any such information gained could be handed over to agents, who, by private enterprise, might create a valuable export trade. The Depôt can also do good work in the distribution of useful pamphlets, thus assisting in the education of the farmer. Seeds and economic plants might also be sold to them with advantage.

Elsewhere we publish a letter from a correspondent proposing the establishment of "Boys' and Girls' Clubs" in the Colony. This appears to us a matter for the managers of the primary schools to deal with, but the success of these clubs in other parts of the world should be, in itself, a recommendation for their trial here. The Depôt should be the legitimate medium for the disposal of the products from these clubs, which would derive all the benefits we have mentioned as likely to accrue to the farmers who partronize it.

PREVENTION OF MOULD IN RUBBER.

Experiments conducted by the Scientific Officers of the Rubber Growers Association have shown that paranitrophenol is very effective as a mould preventive in sheet rubber, and has no deleterious action on the rubber. Recommendation for its use are given in the ***Bull Rubber Growers' Association.*** (1925, 7, 560). Paranitrophenol may be applied either by soaking freshly rolled sheet in the solution or it may be dissolved in the acid used for coagulation. For crepe rubber, the latter method is more suitable.

The material is not readily soluble in water, and plenty of time must be allowed for it to dissolve. After standing, the clear liquor is poured off and care must be taken to prevent any undissolved particles getting into the latex, as dark-coloured specks will result. For this reason the soaking process is safer to use. A 0.1 per cent. solution (approximately 3¼ oz. to 20 gallons of water) is recommended for soaking, the rubber being immersed in it for half an hour (*loc. cit.*, 1926, 8, 40); soaking for three hours, the period originally adopted, is not necessary. In the coagulating process 1½ oz. of paranitrophenol are dissolved in 10 gallons of water to which 5 oz. of acetic acid have been added, and the mixture is used to coagulate 30 gallons of latex standardised at 1¾ lb. per gallon dry rubber content. The material must not be dissolved in the water used for diluting the latex.

MEETING OF THE BOARD OF AGRICULTURE

A Meeting of the Board of Agriculture was held in the Court of Policy Hall Public Buildings on Wednesday, the 26th May, 1926, at 2.30 p.m. The following were present:—W. Francis Esq., F. I. C., (Acting Director of Science and Agriculture), Chairman; S. H. Bayley, Esq.; L. D. Cleare, Jr. Esq., F.E.S. (Government Economic Biologist); Dr. C. L. Whittles, B.A., Superintendent, British Guiana Sugar Planters Experiment Stations; G. E. Anderson, Esq., representative, Royal Agricultural and Commercial Society; The Hon. J. J. Da Silva, E. M. Walcott, Esq., F.R., H. L. Humphrys, Esq., Thomas Earle, Esq., Captain E. Beckett, F.L.S., H. A. Britton, Esq., President, The British Guiana Farmers' Conference; Dr. F. Wills, C. R. Williams, Esq., with E. M. Peterkin, Esq., Secretary.

The Chairman reported the receipt of a letter from the Private Secretary, stating that His Excellency the Governor did not propose to preside at the meeting.

The minutes of the previous meeting held on the 26th. of February, 1926, having been circulated to the members of the Board and having received their approval, were on the motion of Mr. S. H. Bayley, seconded by Mr. H. L. Humphrys, taken as read and confirmed.

The death of Mr. A. S. Milne, M. R. C. V. S., late Government Veterinary Surgeon, on the 11th. March, 1926, was reported. Mr. H. A. Britton moved, seconded by Dr. F. Wills, that the Board's regret at the death of Mr. Milne be recorded, and that the Secretary be instructed to write a letter of condolence to his widow. This was carried unanimously.

The Chairman reported:—

The resumption of duty by Mr. Thomas Earle on the 22nd. of April.

Leave of absence granted to Mr. W. M. B. Shields.

Appointment of Mr. W. Mearns as a Co-optative member of the Veterinary Committee.

The Chairman reported the affiliation of the following Associations :—

The Mahaicony Farmers' Association.
The No. 1 Canal Farming Association.
The Stanleytown Agricultural Society.
The No. 2 Canal Polder Farming Association.
The County of Essequibo Agricultural Association.

Mr. Britton opposed the affiliation of the Mahaicony Farmers' Association on the ground that the Association had not complied with Section 9 of the Regulations governing the affiliation of District Agricultural and Farming Associations, which provided that applications for affiliation must be made through the Secretary of the British Guiana Farmers' Conference.

After some discussion it was proposed by the Hon. J. J. Da Silva, seconded by Mr. Beckett, that the application be returned to the Association with instructions that it be sent through the proper channel.

A further outbreak of Anthrax at Pln. Providence, East Bank, Demerara, on the 20th. April, 1926, was reported. The Chairman informed the Board that the outbreak had been stamped out in a very short time and the quarantine subsequently lifted. Mr. Britton said he thought that as the animals had died after having been inoculated, the owners thereof should be compensated.

The Chairman reported that the Government had informed him that the Executive Committee had advised that in view of the present financial position and the absence of a permanent Government Veterinary Surgeon, the proposal of the Board as to the importation of certain Live Stock during 1926, for which an excess of $2,245 on the vote was required, be allowed to stand over.

The Chairman reported that the Veterinary Committee at their meeting held on the 25th. March, 1926, had decided that it was not desirable that Section 36 of Ordinance 5 of 1920 should be amended, but that they should impress upon the Director of Science and Agriculture the importance and necesssity of exercising great caution, as to what persons were authorised to inoculate and brand animals during an outbreak of Anthrax.

The Chairman reported that the Agricultural Exhibitions Committee had decided on Mr. Britton's motions, forwarded to them, as under :—

Motion.—That the time is opportune for practical steps to be taken for Grading of Local Products for Exportation.

Decision.—That the object was very desirable but that the present was not an opportune moment for enbarking thereon.

Motion.—That a committee be appointed to inquire into the necessity, and report upon the advisability, of the establishment of a government aided Vegetable Products Factory.

Decision.—That the present financial condition of the Colony precluded any such step being taken.

The following were laid on the table for general information :—

Memorandum by Mr. Francis on the report of the Joint Committees of the Sugar Planters' Association, the Chamber of Commerce, and the British Guiana Farmers Conference, on an Export Fruit Industry. On the motion of Mr. Britton, seconded by Mr. G. E. Anderson, it was decided that this report should be circulated to the members.

Reply from Lady Harrison to the letter of condolence from the Board.

Reply from Mrs. Gainfort to the letter of condolence from the Board.

Letter of thanks from R. Ward, Esq., M. B. E., *re* his appointment as an Honorary member of the Board of Agriculture.

Census of Agricultural Industries for 1925.

Journal, Board of Agriculture, Volume XIX No. 2.

Return of acreages under Sugar Cane, and yields, for 1925.

Annual Departmental Report for 1925.

Annual Meteorological Report for 1925.

The Board discussed the question of Live Stock to be imported during 1926.

The Chairman explained that the amount on the Annual Estimates was $1,200.

Mr. S. H. Bayley proposed, seconded by Mr. H. A. Britton that an amount not exceeding $400 be expended on poultry, and that the expenditure of the remainder be left to the Live Stock Committee. This was unanimously carried.

The advisability of holding Agricultural Shows this year, on account of the effects of the prolonged drought was next considered.

The Chairman mentioned that the Secretary of the Berbice Association had written asking that the County Show for Berbice, which was fixed for September, 1926, be held in March, 1927.

Mr. Britton said that the next year was the year for the County Show for Demerara.

Mr. Bayley thought that as a result of the drought, there would be nothing to exhibit, and suggested that they might save the money.

Mr. Walcott suggested that what might be done to meet the altered position, would be for the Board to decide that the Berbice and the other two County Shows be postponed for twelve months. Berbice could have theirs in 1927, and Demerara in 1928.

Messrs. Beckett, Da Silva, Britton and Dr. Wills were in favour of holding Shows this year.

It was eventually decided that this be left to the Agricultural Exhibitions Committee to decide.

The following questions and motions by Mr. H. A. Britton, President, British Guiana Farmers' Conference, were dealt with :—

Question 1 :—Whether or not the Board will recommend to Government the necessity for the introduction of a Bill for the Inspection of Local Produce intended for exportation along the lines of the Dominica Exportation of Fruit Or,dinance, 1926 ?

Question 2 :—What industries not affected by drought and flood will the Department of Science and Agriculture recommend, for the inhabitants of the Colony to embark upon ?

Question :—3 :—Whether or not the Department of Science and Agriculture has carried out; if not, will it carry out experiments with a view of ascertaining the best variety required for the production of Black Tobacco ?

After some discussion Mr. Britton decided to leave these over.

Question 4 :—Whether or not a copy of the report on the Canje District by the then Government Botanist, Mr. A. W. Bartlett, who was accompanied by Mr. King, is available ; if so. I ask that it be laid on the table prior to publication in the Journal of the Board ?

Answer :—The Secretary replied that up to the present, he had been unable to find same.

Question 5 :—Has the report of the Committee with respect to the establishment of Agricultural Stations for the trial cultivations of Bananas, Citrus Fruits and other Economic Products suitable for exportation and approved by this Board been forwarded to the Government ; if so, what practical steps have been taken by the Acting Director of Science and Agriculture for the establishment of the first station ?

Answer :—Yes, it has been submitted to Government.

Question 6 :—What steps, if any, have been taken to get Government to place at the Disposal of the Director of Science and Agriculture a sum of money, to be used by the Director in consultation with the Director of Co-operative Credit Banks, to assist small farmers to again make a start after the drought ?

Answer :—The Chairman informed him that this was a subject with which the Drought Committee were dealing

Motion 1 :—That regular quarterly meetings of the Board of Agriculture be held on the third Tuesday in the months of January, April, July and October.

The Chairman explained that at a General Meeting held on the 3rd. February, 1925, the President, Sir Graeme Thomson fixed the months of January, May and September for general meetings to be held, and that it was not practicable to fix any definite day in each month.

Mr. Britton withdrew his motion.

Motion 2 :—That steps be taken for the establishment of a Stock Farm within easy reach of Georgetown.

The Chairman informed them that this was under consideration, but it was agreed that he should appoint a Committee to deal with and report on it.

The Chairman suggested that a date be fixed for the inspection of the Botanic Gardens, but the members suggested that he fix a date and notify them of same.

On the motion of the Chairman seconded by Mr. E. M. Walcott, the under-noted Order under Section 23 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920, was unanimously confirmed :—

DATE OF ORDER.	AREA DECLARED	DISEASE.
21st. April, 1926.	At Pln. Providence, East Bank, Demerara, bounded on the North by the side-line opposite Head Overseer's house, on the South by No. 3 Canal, on the East by the Public Road, and on the West by the Demerara River.	Anthrax.

On the motion of the Chairman seconded by Mr. E. M. Walcott, the above-noted Order under Section 23 of the Improvement of breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920, was then unanimously revoked.

The Chairman then adjourned the meeting to a date in September to be fixed later.

* * *

AGRICULTURAL CENSUS RETURNS.

COMPARATIVE SUMMARY.

Areas Under	*BRITISH ACRES.*			
	1922	1923	1924	1925
Sugar-cane (under cultivation)	60,761	55,130	57,200	57,500
Sugar-cane (reaped) ...	56,545	50,510	51,355	55,676
Rice (under cultivation) ...	49,070	34,965	29,406	29,333
Rice (reaped)...	60,460	38,715	40,272	39,890
Coconuts ...	26,600	22,970	25,188	29,979
Cacao ...	1,370	1,903	1,900	1,918
Coffee ...	4,240	4,096	5,685	6,243
Rubber ...	2,330	2,080	1,655	2,200
Limes ...	660	800	710	655
Provision Crops	11,370	11,924	14,443	11,715
	CROPS.			
Sugar, tons ...	101,128	90,758	91,782	107,580
Rice, bags of 140 lbs. ...	545,360	532,400	673,610	614,451
Coconuts, Thousands * ...	22,352	15,923	12,303	17,617
BRITISH GUIANA.	*LIVE STOCK.*			
Horses ...	1,710	1,610	1,796	1,776
Asses	6,170	5,450	6,176	7,673
Mules ...	1,750	1,840	2,300	2,245
Horned Cattle	111,900	102,170	113,315	134,629
Buffaloes ...	190	264	175	282
Sheep ...	16,980	15,355	16,185	24,399
Goats... ...	8,300	7,965	9,792	13,650
Swine ...	12,310	11,864	12,889	15,560

* Reliable returns not available.

THE PRINCIPAL VARIETIES OF SUGAR CANE IN BRITISH GUIANA UNDER CULTIVATION DURING 1924, 1925, 1926.

By the Director of Science and Agriculture and the Secretary of the British Guiana Sugar Planters Experiment Stations Committee.

AREAS IN BRITISH ACRES.

Variety.	1924. acres.	1925. acres.	1926. acres.	Increase or Decrease on 1925.	
				Increase.	Decrease.
D. 625.	37,108	37,413	39,193	1,780	
Bourbon.	391	323	362	39	
D. 625 mixed with Bourbon & other seedlings.	7,126	9,201	8,300		901
D. 145.	3,496	2,649	2,854	205	
D. 118.	1,656	1,576	1,891	315	
R. P. 8.	498	461	285		176
B.H. 10 (12)	295	190	226	36	
B. 208.	625	403	204		199
Diamond 37.	363	316	154		162
P.L. 2.	79	103	139	36	
D. 109.	125	127	116		11
D. 419.	102	84	70		14
Ba 6032.	138	89	56		33
D. 179.	52	46	46		
D. 167.	37	51	37		14
Diamond 10.		5	34	29	
Diamond 581.	85	55	29		26
G. Transparent.	38	29	16		13
Small areas under other varieties & areas under varieties unenumerated.	504	269	88		181
Total Estates' Canes.	52,718	53,390	54,100	710	
Total Farmers' Canes.	2,412	3,800*	3,400*		
Totals.	55,130	57,190	57,500		

* Areas at Plns. Anna Regina & Hope transferred to Farmers' Canes.

The following table indicates the relative distribution of the various kinds of cane during the crops of 1921, to 1926 inclusive.

Variety.	For Crops of					
	1921.	1922.	1923.	1924.	1925.	1926.
D. 625.	56·5	59·4	65·4	70·4	70.1	72.5
Bourbon	3·5	2·5	2·7	0·7	0·6	0.6
D. 625 mixed with Bourbon and other Seedlings.	13·9	15·2	11.5	13·5	17·2	15.5
D. 145.	7.5	7·3	7·1	6·6	4·9	5.2
D. 118.	4.8	4·1	3·6	3·1	2·9	3.5
Providence 8.	1·6	1·3	1.5	1·0	0·9	0.5
B. 208.	3·4	3·0	2.0	1.2	0·8	0.4
Diamond 37.	0·2	0.3	0·6	0·7	0·6	0.3
B.H. 10 (12)	0·2	0.3	0·4	0·6	0·3	0.4
D. 109.	0·5	0·5	0·3	0·2	0.2	—
Diamond 185.	1·3	1·0	0·9	0·3	—	—
Ba 6032.	0·3	0.4	0·5	0·3	—	—
D. 419.	2·7	1·6	1·1	0·2	—	—
Other Varieties unenumerated.	3·6	3·1	2·4	1·2	1·5	1.1
	100.0	100·0	100·0	100·0	100.0	100.0

From the returns supplied by the Sugar Plantations, the distribution of the various sugar canes in cultivation for the crops of 1921 to 1926 inclusive, according to their origin is as follows:—

Variety.	1921	1922	1923	1924	1925	1926
Bourbon and other old Varieties.	8·8	8·2	9·2	4·8	5·1	5.0
Java.	1·1	0·4	0·1	0·1	0·1	—
Barbados.	4·4	4·1	3·2	2·2	1·4	1 0
British Guiana :—						
Plns. Diamond & Providence.	3·3	3·5	3·7	2·6	2·2	1.2
Botanic Gardens.	82.4	83·8	83·8	90·3	91·2	92.8
	100·0	100·0	100·0	100·0	100·0	100.0

The average yields in tons of commercial sugar per acre of the principal varieties under cultivation for the crops of 1925, as deduced from the returns supplied by the Managers of the Sugar Plantations, were as follows:—

Crops of 1925.

	B. H. 10 (12).		D 118.		D. 419.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	2·63	192	2·55	1,086	2·49	109
Maximum reported ...	3·06	53	3·11	89	3·90	21
Minimum reported ...	2·02	65	1·96	94	1·46	49

	D 145.		<> 37.		D 109.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	2·38	2,342	2·34	282	2·25	86
Maximum reported ...	2·80	5	2·42	263	3·40	40
Minimum reported ...	1·94	24	2·27	19	1·44	8

	Bourbon.		D 625.		Ba. 6032.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	2·25	43	2·22	27,971	2·12	1 20
Maximum reported ...	2·68	6	2·98	2,824	5·18	4
Minimum reported ...	1·71	7	0·70	208	1·10	19

	Mixed.		B 208.		Green Trans-parent.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean of all plantations	2·10	7,438	1·95	376	1·88	32
Maximum reportd ...	2·92	42	2·32	133	2·00	7
Minimum reported ...	0·70	352	1·57	215	1·76	25

Many of the smaller plantations, owing to the scant labour supply, were not in a position to keep up their cultivations as they otherwise would have done, as a result of which their crops were short. It is desirable to record separately the results supplied by the Managers of the larger and hence more favourably situated plantations. The results were as follows:—

	B H 10 (12)		D 118		D 419	
	Yields	Acreage	Yields	Acreage	Yields	Acreage
Mean, larger plantations only	2·65	168	2·65	1,056	2·49	109
Maximum reported	3·06	53	3.11	89	3·90	21
Minimum reported	2·02	65	1·96	94	1·46	49

	D 625		D 109		D 145	
	Yields	Acreage	Yields	Acreage	Yields	Acreage
Mean, larger plantations only	2.40	25,245	2·40	80	2·38	2,342
Maximum reported	2·98	2,824	3·40	40	2·80	5
Minimum reported	2·00	912	1.44	8	1.94	24

	Mixed.		<> 37		Bourbon.	
	Yields	Acreage	Yields	Acreage	Yields	Acreage
Mean, larger plantations only	2·38	4,231	2·34	282	2·25	43
Maximum reported	2·92	42	2·42	263	2·69	6
Minimum reported	1·90	43	2·27	19	1·71	7

The results of large scale field-trials with other varieties on the sugar plantations are shown in the following table :—

Varieties.	Acreage.	Yield.
D, 433.	7	2.92
D. 108.	16	2.89
R. P. 21.	18	2.85
D. 747	5	2.80
R. P. 8.	438	2.73
D. 167.	35	2.54
Diamond 185.	4	2.54
Diamond. 581.	51	2.42
R. P. 20.	27	2.40
D. 199.	23	2.33

RETIREMENT OF MR. R. WARD, M.B.E., SUPERINTENDENT OF BOTANIC GARDENS AND AGRICULTURAL STATIONS.

By Edgar Beckett.

With the retirement of Robert Ward, M.B.E., from the Service of this Colony, we have lost a Botanist whose severe modesty has, perhaps, caused many to lose sight of the great work he did for the Herbarium of this Colony.

Mr. Ward has been so long associated with the Botanic Gardens that one can hardly visualise him in any other connexion. Born in Perthshire, Scotland, on 23rd April, 1860, he served his apprenticeship in the Dunkeld Gardens, the property of the Dowager Duchess of Athol. When his journeymanship terminated, he entered the service of Dickson and Company, of Edinburgh, one of the principal Nurserymen in Scotland. He spent three strenuous years at Dickson's, where he learnt all the practical work of gardening, including the skilled arts of this profession.

He was still, however, determined to carry on his studies in Botany, and for this purpose, he entered the world-famed Gardens at Kew. Here he did excellent work, becoming the head of one of the Departments, and having under him, men who have since become famous in the Botanical World. He spent three and a half years at Kew, and early in 1886 came to British Guiana to take charge of the Nurseries a The Botanic Station.

When he arrived in this Colony no one knew anything about propagation work, potting of plants, pruning and general garden work, with the exception of Mr. Jenman and Mr. Waby. Together with that well-known Botanist, the late George Samuel Jenman, F.L.S., the then Government Botanist, Mr. Ward set to work, and it was not very long before he transformed the existing Nursery, ino something that the Colony could be proud of. It must be remembered that, at that time, he had to teach the practical work to everyone, since not one of the labourers knew anything at all of Nursery work. He was an expert at grafting and potting, and the raising of every kind of seedling. He found some of the East Indians apt pupils, and turned out several very skilled men. His capacity for down right physical hard work, we make bold to assert, has never been equalled by any man in this Colony, not excluding the great Sugar-King, William Russell. Tireless himself, he was able, in some mysterious manner, to infuse energy into all the men under him. It was not long before his skill and ability gained recognition, and he was offered the post of Botanist in one of our West African Colonies. This he accepted, but when he saw how much his chief (Mr. Jenman) grieved at the idea of his leaving, with the great work they had started not completed, he afterwards declined the appointment. Not long after this he was seconded to carry on under Mr. Jenman and afterwards under Jenman and Professor Harrison, the important work of raising Seedling Sugar Canes—at which time he was paid by the Imperial Government. For this work, somewhere about 1901, he was specially thanked by His Majesty's then Secretary of State for the Colonies.

When the new Department of Science and Agriculture was formed, Mr. Ward was drafted into this and continued the work of raising Seedling Canes and assisting in the training of farmers and others, in practical Agriculture. Without Mr. Ward's help, we are very doubtful whether we should have seen these experiments carried to so successful an issue, as has been the case. If we are not mistaken, D 625 might have been thrown out as useless (as was its sister D 626), were it not for his foresight.

The amount of sheer, hard work he has put in, with respect to these experiments, is inconceivable! He was ever ready to put his Work first, and his Pay last. As long ago as 1888, Jenman writing about the work in the Herbarium in one of his annual Reports stated that, "the classification has been completed by Mr. Ward, working on holidays and in unofficial hours." We have known him, for reasons that seemed good to himself, remain in the fields, day after day, from 6.30 a.m. to 9 p.m., weighing canes by lamp-light, so as to push on with work which was urgent. The extra pay for the men usually came from his own pocket. This may have been unwise, but it is characteristic of his whole life in the Colony. Utterly unselfish, devoted entirely to his work, and modest to a degree which bordered on being foolishly so, he was the most loyal of officers. His devotion to Jenman and Harrison had something in it that was almost pathetic. His aesthetic taste in flowers and his knowledge of tone-value in colours, was most remarkable. There has never been anyone in this colony who so thoroughly understood the culture of the grape. Again out of his own pocket, he imported and cultivated at the Experimental Station, a number of the most delicate varieties of grape, teaching the pruning of the vines to anyone who cared to learn. He grew most magnificent Black Hamburgs and other superior varieties, with splended success. Amongst his apt pupils was the late Mr. D. V. Jacobs, who, for a number of years, cultivated grapes quite successfully at Buxton, East Coast, Demerara.

To Sir John Harrison, Mr. Ward, was invaluable. On all Sir John's trips into the Interior, Mr. Ward accompanied him. He also made several trips into the Interior in the interest of our local flora. He added materially to the collection of the very fine Herbarium at the Botanic Gardens here, and to Herbaria in many parts of the world. It was he who obtained seed of the rare and interesting palm ***Hyospathe elegans***, at Eagle Mountain, Potaro. His knowledge of plant life was not confined to the practical side, though he will be remembered more especially in this connexion. He had, also, a sound scientific knowledge of Plant life—sounder than many suspected.

Mr. Ward took a very great interest in the Agricultural and Live Stock Shows held in this Colony, and only those who were associated with him know the amount of absolutely unselfish service he gave, to make every Show a success. It is of interest to note that, Mr. Ward, during all these active years of service, has had but one holiday of six months, most of which was spent in a Hospital in London, owing to a fracture of the arm, the result of a fall from his bicycle.

Mr. Ward will be assuredly a great loss to the Colony, but, nevertheless, the good work he has done has already borne fruit. He deserves all the happiness which a man in sound health and vigour should secure, after some forty years strenuous work in this Colony, in his honoured retirement from his duties. We trust that he will still favour the Board of Agriculture (of which he has been appointed an Honorary Member) with his advice from time to time.

Recognition to workers often comes slowly, and where the modesty of a man is a marked feature, it may be years before any appreciation is publicly expressed. It was not until quite recently that the distinction of Membership of The British Empire was conferred upon Mr. Ward.

To Mr. Ward, Work, with a very large capital, meant almost everything. Stern though he was in connexion with Work, his Charity, given to all, is well-known. Indeed his kindness of heart was only equalled by his greatness in having an honest purpose in Life. He recalls to us, that famous line in Horace's Odes : ***Justum et tenacem et propositi virum*** :

A LOCAL INDUSTRY.

By S. N. Bruce, M.V.D., Acting Government Veterinary Surgeon.

High Feeding Value Of Copraline.

Copraline is the only cattle feed (patented) containing the digestive virtues of the coconut kernel, coconut oil, and sugar cane, and is used with the very best results in British Guiana by the Government Farms, Botanic Garden Station, Sugar Estates, and leading cattle owners, where there is plenty of convincing evidence concerning the value of Copraline as a truly efficient feed for producing the greatest flow of milk, for prolonging the lactation period, and for keeping the animals in good condition.

GREAT VALUE TO HORSES, MULES AND DONKEYS.

It is interesting to know that it has been found of great value to horses, mules and donkeys. The Government Stud Farm, Mounted Police Horses, Municipal Stables, and most of the heavy draught animals do particularly well on this feed, especially is this the case of animals transporting lumber on the wood grants—perhaps the severest test of endurance for any animal.

Thousands of bags of Copraline are exported annually, and highest testimonials have been received from leading British Authorities and Agricultural Colleges.

This feed is highly concentrated, and it is well worth while to briefly describe its manufacture, and the ingredients from which it is prepared.

MANUFACTURE DESCRIBED.

The value of the first ingredient molasses as a food has long been recognised, but nevertheless, it cannot be regarded as a complete food in itself, but is an excellent substance to mix in greater or lesser quantities with other nutriment. It is free from the excessive saline matter which beet sugar molasses contains, and from the objectionable smell and flavour of the latter.

This molasses is brought down from the Sugar Estates in punts, being put up in strong barrels or hogsheads—which by the way, always have to be carefully coopered, as molasses has an unfortunate habit of fermenting—After being emptied out in the boiling pans, the molasses is thoroughly concentrated, a density of 48° Bé being sought, and is then ready for mixing, and in this form will help fatten stock enormously, by reason of the large amount of carbohydrates—SUGAR—which it contains, and the same cause leads it to be particularly suitable for use where great muscular work is required.

The next ingredient used megass, is the cellular portion of the sugar cane itself, formed of a number of minute cells, obtained from the coarse megass by disintegration and screening. A large portion of this substance is a digestible food in itself; it is likewise a powerful absorbent, and possess the property of imbibing four times its own weight of molasses. This fact, however, is not altogether surprising, when it is remembered that the cells of which this honey-combed ingredient is chiefly formed, originally held about eight times their weight of cane juice.

This fine megass usually contains somewhere around 25 per cent. of water and every care has to be exercised in drying. The apparatus—a very elaborate and expensive one—consists of a revolving drum fitted with a series of internal circumferential divisions placed within a large brick compartment, where hot air passes and heats the drum. As the latter revolves, the fine megass continuously falls in showers from the top to the bottom; and under the influence of this applied heat, gives up its contained moisture and is ready for mixing.

The third, and most important ingredient of Copraline, is obtained from the coconut in two forms:—

(1) The flesh after the kernels have been broken, desiccated through the mills, pressed and dried at a fixed temperature.

(2) The residue from the process of boiling the coconut oil—solidified oil—which is locally called 'chancy' or 'poonac.'

These two ingredients alone are rich in albuminoids and oil, and if fed to livestock give splendid results.

It can readily be imagined then, what a rich, well-balanced food is obtained, when all the above mentioned ingredients, are associated together in fixed proportion, and the whole compound passed through specially prepared mixing machines; further not only is this feed economical, rich in nutritive and force giving material, but its excellent flavour conduces largely to its appreciation by animals. This mixture is next removed to the cooling chamber, and after an expiration of 48 hours weighed and bagged.

IMPORTANCE OF CONDITION.

Emaciation in cattle, except that caused by recognizable disease, must be considered as due to inadequate or faulty nutrition.

It is a condition which develops when the destruction of body tissues takes place more rapidly than the processes of repair and growth, the nutritive reserves of the body becoming exhausted and the animal being obliged to utilize the muscle and other tissues in order to support life. Any loss of condition in a cow should be anticipated and extra food given. After a long course of milk-giving, cows are apt to fall off in condition. The fact is, cows should be kept in as good condition as possible, not only in the dry season, but all the year round.

Due to the prolonged drought, every description of cattle in the Colony is suffering from emaciation, and to quote the Chairman, of the VICTORIA—BELFIELD AGRICULTURE SOCIETY, at the last monthly meeting. "Farmers must bear in mind that if they want their stock to give proper satisfaction, they must be properly fed. I recommend Copraline, a feed I have used with beneficial results."

It would be as well to state here that SIR JOHN HARRISON C.M.G., M.A., F.I.C., F.G.S., ETC. late Director of Science and Agriculture and Chairman of the Board of Agriculture, carried out a series of experiments with Copraline. at the Government Farm Onderneeming. the results being highly satisfactory.

REGULARITY IN FEEDING.

The hours of feeding cows are not of primary importance ; but it is of the greatest importance that the hours fixed upon should be rigidly adhered to, as cows suffer greatly from want of regularity in feeding as in milking. When kept tied up all day, they want feeding four times, at equal intervals of time. Those out all day should be fed morning and evening.

WATER SUPPLY.

Under whatever system dairy cattle may be fed and managed, it cannot be too strongly impressed the utter necessity of an abundant supply of pure fresh water. It is absolutely essential for them if they are to give a good yield of milk. Pure Spring water is the best, but very hard or chalky water is not good, nor well water unless very pure. Stagnant water, and water which is impregnated with sewage is naturally poisonous to the cows, the milk, and the milk consumer ; but it is to be feared care to avoid such water being used by cows is sometimes wanting.

Professor Daniels asserts that anyone can see that the yield of milk is directly proportionate to the quantity of water absorbed, which conclusion he has arrived at by comparing the quantity of water absorbed by various cows in yield. He asserts, moreover, that a cow not habitually drinking as much as 27 quarts of water a day—and he has met with such—is actually and necessarily a poor milker. She will give only from 5½ to 7 quarts per day ; but all cows seen by him which drink as much as 50 quarts of water daily were excellent milkers. In his opinion, the quantity of water consumed by a cow is a valuable test of her worth as a milk producer.

BUTTERFAT—THE MOST VALUABLE CONSTITUENT OF MILK.

The most valuable constituent of milk is butterfat, and the production of milk as rich as possible in fat is as a rule, the chief aim of dairy-farmers. A number of experiments have accordingly, from time to time, been made with the view of ascertaining whether the fat of milk can be increased by any particular form of food, but the cow is such a 'changeable and complex milk machine' that definite results are difficult to obtain. The weight of evidence of my experience, however, goes to show that provided a cow receives sufficient of any nutritious and acceptable food the percentage of butterfat is materially increased by enriching the ration.

GOLD CUP WON.

It is here well worth mentioning that Copraline Cattle Feed was instrumental in Messrs. A. & J. Brown, 'Hedges Farm,' Hertfordshire, one of the pioneers in the British Frisian cattle world, winning the Earl Spencer Gold Cup, which is "The Blue Ribbon of the Dairy. Herds Competition" being open to all cows in the United Kingdom, irrespective of breed, gaining the highest number of points in, inspection, milking trials, and butter tests. The cow in question being "Hedges Sweet Buttercup" which along with Messrs. A. & J. Brown's pedigree and prize-winning cattle, was from birth fed on Copraline

JOTTINGS.

By Edgar Beckett, F.L.S.

Parrots As Pests.

The Agricultural Instructor for Berbice (Mr. E. M. Morgan), reports the fact that heavy losses have occurred to growers of fruit through the depredations of parrots.

He points out that within recent years these birds have become regular visitors to cultivated areas, causing considerable loss to farmers. During the recent drought, according to Mr. Morgan, they deserted the forests and appeared in certain cultivations in their thousands. They have wrought havoc in lime groves, and have destroyed crops of mangoes and oranges.

Instances are quoted where yields were reduced from 5 to 6,000 barrels of limes to less than 400, one farmer with 300 orange trees is reported to have lost every single fruit, whilst mangoes have suffered in a like manner.

These serious losses are said to be caused entirely by the depredation of these birds.

The writer has himself seen the enormous damage these birds can cause in a lime cultivation.

They are extremely difficult to deal with. No matter how one attempts to control these birds by pitiless shooting, flock after flock re-appears. They hide amongst the green foliage of the lime trees, dash off to another tree and are remarkably bold.

They do considerable damage in their flight through the lime shrubs by knocking off very young fruit and flowers.

They eat the lime seeds. It is not an uncommon sight to see thousands of lime fruit under a tree in all stages of growth, from quite small green fruit to full yellow fruit battered, and burst, where the parrots with their strong beaks have removed the seeds.

The damage done is very considerable. The loss to small farmers growing fruit such as Oranges and Mangoes in certain districts must be seen to be appreciated. Shooting is of little avail. Mr. E. M. Peterkin suggests poisoned bait in the shape of maize in trays about the fields. Some such method, with persistent shooting may control them. We may be lucky in not having parrots feeding on sheep's kidneys but it certainly is unfortunate that this screecher should be added to the list of the numerous enemies our farmers have to face.

THE TYPHOID FLY AND MOSQUITOES.

The common house fly should be known, locally, to our children as the Typhoid Fly.

Encouragement appears to be given to the breeding of this extremely dangerous pest.

If not actually proved, there is sufficient circumstancial evidence to connect this typhoid fly with such diseases as cholera, dysentery and various parasitical worms. It may be taken as a fact that these flies come from the filthy places where they are breeding, straight into the house, and if not actually carrying disease germs, they are bound to be carrying filth. Perhaps, if this fact were rooted in the minds of all our people, a greater horror would be instilled into everyone, concerning this abominable fly.

It is astonishing how many persons seem to think nothing at all of allowing flies to swarm over their food, and many think nothing of drinkiug milk, or any other liquid, into which a fly has tumbled and perished.

As a routine, all school children should be made to look upon the typhoid fly as one of their greatest enemies.

If a snake, even if quite a harmless individual, be found in the school room, there is a "cry and a shout and a deuce of a rout" and every haste is made to despatch the reptile.

If a labba "tiger" were found in the school yard, the excitement would be intense, but, the danger is nothing at all, compared with the danger surrounding the typhoid fly.

Flies and Mosquitoes should not be regarded with equanimity.

They should be looked upon as the most dangerous of pests and everyone should do his or her best to get rid of them.

Mosquitoes in Georgetown, for the most part, may be considered as winged messengers of death, and, from childhood, every citizen should be taught to do everything possible to prevent attacks. Much can be done in the way of protection.

It is a matter for astonishment how few people seem to realise that protection from these two pests, is quite within the realms of practical politics.

THE DROUGHT.

There is one grain of comfort to be gathered in connection with the terrible drought we have recently experienced.

A long period of excessive rain, does more harm in the cumulative sense, than does a protracted period of drought.

The ground cannot be worked and though the damage may not be noticed at the time, the result of very heavy rainy seasons is most marked. On the other hand a period of drought often does good to the soil, and if worked, the soil aeration that is obtained results, when the rains do come, in better crops.

Though the sugar cane must have a considerable amount of moisture and requires in this colony a well distributed fall of from 80 to 100 inches a year, yet we can look forward, in the near future, to bumper crops.

In 1880 the date of the birth of the Botanic Gardens, Georgetown, the rainfall was 78 inches 17 parts.

In 1881	87·32
,, 1882	94·90
,, 1883	62·94
,, 1884	74·42
,, 1885	59·05
,, 1886	99·55

In 1886 the yield of canes per acre, after the drought of 1885, was excellent, and though a large area in Sugar-cane had been thrown out owing to the bad weather in 1885 and 1884, combined with low prices, yet there was a considerable increase in the exports of Sugar namely 124,283 Hhds. as against 106,731Hhds. in 1885, the money value in favour of 1886 being represented by £40,792.

With regards to crops other than Sugar, there was over-production in 1886. We may look forward to splendid crops after the drought, and if the scheme of having a Vegetable Depôt for farmers' crops is satisfactory, the question of over-production may not deprive the small farmer of the just reward of his labour.

MOTOR CULTIVATION.

The question of Motor Cultivation is deserving of thought.

With the Rototiller now working on more than one Sugar Estate in the Colony, we are looking forward to attention being turned to the cultivation of rice lands by mechanical means. The experiment is well worth the attention of some of our larger rice growers. If successful, it should not be difficult, through the aid of the Co-operative Loan Banks, for certain of our Villages to own, on co-operative lines, a machine, suitable for the preparation, cultivation, and harvesting of Rice.

GOATS.

Attention should be given by our farmers, to the question of keeping goats for milking purposes. Milch goats should play as important a part in this Colony, as milch cows. It is extremely unfortunate that goat breeding receives so little attention, that it is almost impossible, at present, to obtain a good milking Nanny.

Goats kept entirely for milk, would prove remunerative, and need not be allowed to become a nuisance and a menace to neighbouring gardens or vegetable plots.

SUNFLOWERS. (*Helianthus annuus*).

We would plead for the planting of Sunflowers on a large scale. The plant grows luxuriantly in this Colony, and the value of the oil produced from the seed, is of commercial importance.

Apart from this commercial view, the seeds are extremely valuable as a food for poultry—especially in wet weather.

With soil prepared by a Rototiller, huge areas could be put to sunflowers at very little cost, and an oil Industry of importance started as a subsidiary industry, which has a chance of becoming one of great importance to the Colony.

Both in Russia and India, this plant is grown for its oil seeds.

If the trees are topped, there is an increase in the yeild of seeds—1000 seeds should be produced by each plant. The percentage of oil in this climate could easily be ascertained, but it probably is about 15 to 16 per cent.

The oil is compared with ground-nut (***Arachis hypogœa***) oil, whilst in Russia, it is used chiefly in adulterating olive oil.

We already have a local soap-making industry, so that the fact that the oil is useful for this purpose, is not without interest. Purified, it is quite equal to olive oil. In colour it is a pale yellow.

The residual cake is excellent food for cattle. When one considers the amount of land available, the ease with which the plant grows here, with practically no cultivation, it will be seen that here may be an opportunity for some enterprising farmer to start this experiment.

The chances of establishing a Sunflower Oil Industry are very much better than the hope of exploiting our Kokerite palms (***Maximiliana regia***) for palm oil.

A few acres grown experimentally, would soon give the desired data as to cost of cultivation, percentage and cost of expression of the oil.

THE FLUOSILICATES AS INSECTICIDES.

By S. Marcovitch

Agricultural Experiment Station, Knoxville, Tenn.

The first extensive experiments with the fluosilicates as insecticides were carried out at Knoxville, Tenn., in ths spring of 1924. Comparatively favourable results were obtained which were reported in Bulletin 131 of this station. The sodium salt was the only one available in commercial quantities, but it was not particularly adapted for dusting. Last summer one concern placed a " light " and " extra light " sodium fluosilicate on the market, and there has also appeared a commercial calcium fluosilicate. These chemicals were tried out in the field and much additional information was obtained. The results are not entirely conclusive, however, because the hot, dry summer kept the bean beetles from multiplying.

Sodium Fluosilicate—Extra " Light "

The " extra light " consists of 70 to 75 per cent sodium fluosilicate. According to the distributors, the remainder is silica. It was found, however, to be alumina which was used as a colloid to make a bulkier precipitate. This material occupies about 60 cubic inches to the pound and represents a decided improvement as far as bulk is concerned. The individual particles vary in size from 5 to 30 microns. A good grade of calcium arsenate occupies 80 cubic inches to the pound and the particles appear to be 2 to 4 microns in size. For many insects there appears to be sufficient fluorine in the " extra light " when used undiluted to secure a kill. For insects that feed sparingly, such as the boll weevil, the large amount of filler detracts seriously from the value of the material. It cannot be mixed with hydrated lime without seriously impairing its toxicity. When used undiluted the " extra light " is safer on foliage than the commercial sodium fluosilicate. On tobacco severe injury sometimes results.

CALCIUM FLUOSILICATE

The calcium fluosilicate was marketed as "calcium fluosilicate compound." This material is a by-product in the volatilization method of treating phosphate rock for phosphoric acid. It is insoluble and, therefore, safe on foliage, such as tobacco. It is light and fluffy, the particles being about 5 microns in size, and marketed in two forms, one occupying approximately 70 cubic inches to the pound and the other approximately 120 cubic inches to the pound. When used at the rate of 5 pounds per acre, the "compound" is not so toxic as the sodium fluosilicate. However, at the rate of 30 pounds to the acre, the control against the Mexican bean beeetle was good.

The manufacturers have discovered a method of increasing the fluorine content of the "compound" which should materially enhance its value as an insecticide.

TEST WITH THE FLUOSILICATES AGAINST CERTAIN INSECTS.

The "calcium fluosilicate compound" appears to be very effective against flea beetles, such as the new mint flea beetle in Michigan. In Arkansas, Baerg found that the blister beetles, heretofore not successfully controlled by arsenicals, are very susceptible to the fluosilicates. These beetles are especially injurious to soy beans where they are found in swarms. No appreciable injury was caused by the commercial sodium fluosilicate to soy bean foliage or alfalfa when diluted with an equal quantity of hydrated lime.

The control of the striped cucumber beetle has previously been far from perfect. It is a very difficult insect to poison with arsenicals because they act as repellents. Since the beetle has the habit of cleaning its feet by drawing them through its mouth, it would be expected to yield to the fluosilicates, and such was found to be the case. On June 12, several rows of cucumbers were dusted lightly with commercial sodium fluosilicate about seven o'clock in the morning. Eight hours later it was difficult to find a live specimen, while dead beetles were numerous on the ground about the plants. As some foliage injury is produced when the commercial sodium fluosilicate is used undiluted, it would be advisable to mix it with 2 or 3 parts of hydrated lime. The "extra light" sodium fluosilicate also give good control and no burning when used undiluted. Cage tests showed that beetles succumbed to heavy applications of the calcium fluosilicate compound.

When the fluosilicates were mixed with bran in the proportion of 1 to 20, they were found effective in cage tests against grasshoppers and cutworms. There is some evidence that arsenic is somewhat repellent when used in cutworm baits, but this does not appear to be the case with the fluorine compounds.

Roaches were readily controlled with commercial sodium fluosilicate by sprinkling some of the powder in the corners of the pantry or on kitchen floors. In a few cases dead mice were found where the powder had been used. Sodium fluosilicate is also very useful against chicken lice when dusted in the feathers.

One great advantage of the fluosilicates over the arsenicals is their effectiveness against a variety of insects which cannot be controlled by arsenic. Furthermore, the fluosilicates appear fully as toxic as the arsenicals in quantitative tests against certain insects, whereas against man arsenic is far more poisonous. Sollman states that the fatal dose for the trioxide varies from 0.1 to 0.3 gram. Arsenic is also a nerve and capillary poison so that minute quantities are capable of destructive action. The fatal dose for sodium fluosilicate is not given, but for sodium fluoride is said to be 0.5 gram per kilogram of body weight. This means that arsenic trioxide is from 100 to 300 times as poisonous to higher animals as sodium fluoride.

Compatibility With Fungicides Or Insecticides

Calcium fluosilicate does not appear to react to any great extent with lime-sulfur or Bordeaux mixture. Sodium fluosilicate, however, precipitates sulfur out of the lime-sulfur and the two are, therefore, not compatible, especially for use on apples, A 3:3:50 Bordeaux with sodium fluosilicate at the rate of 2 pounds to 50 gallons of water was not injurious to potato foliage and was toxic to the larvae of the potato beetle.

According to Kerr and Smith, sodium fluosilicate with either calcium arsenate or Paris green tends to liberate free, water-soluble arsenic (As_2O_5) with consequent injury to foliage. In one experiment 87.87 to 93.80 per cent of the total amount of As_2O_5 in the calcium arsenate was leached out of a combination of distilled water and a mixture of equal parts of calcium arsenate and sodium fluosilicate.

With lead arsenate only 1.5 per cent of the total amount of As_2O_5 was leached out, while Paris green gave 9.4 per cent. Sodium fluosilicate in a mixture of calcium arsenate or Paris green is, therefore, not safe to foliage. Calcium arsenate left in dust guns may also be responsible for foliage injury when the same gun is used for dusting with sodium fluosilicate.

GERMICIDAL VALUE

In a paper presented before the American Phytopathological Society on December 31, 1925, H. W. Anderson discussed "The Control of Bacterial Spot of Peach with Sodium Silicofluoride." Bacterial spot (***Bacterium pruni***), considered the most serious disease of the peach in Illinois, is not controlled by the ordinary fungicides. Dr Anderson found that sodium silicofluoride in dilutions of 1 to 4000 to 1 to 4500 would always render broth sterile when inoculated with ***Bacterium pruni***. Sodium silicofluoride was found only moderately fungicidal inhibiting the germination of bitter rot spores (*Glomerella cingulata*) in dilutions of 1 to 800 when added directly to the spores suspension. Field tests showed practically no infection of bacterial spot, whereas those trees not sprayed with sodium silicofluoride showed 20 to 80 per cent of the leaves infected. ——*Industrial and Engineering Chemistry, Vol. 18, No. 6.*

THE PENETRATION OF FRUITS AND VEGETABLES BY BACTERIA AND OTHER PARTICULATE MATTER AND THE RESISTANCE OF BACTERIA, PROTOZOAN CYSTS AND HELMINTH OVA TO COMMON DISINFECTION METHODS.

(Amer. Journ Hyg.,—Vol. 5, p. 559).—A brief summary of the conclusions arrived at are that :

(1) Normally uninjured fruit vegetables do not contain living bacteria ;

(2) Finely divided matter such as carbon, protozoan cysts and ova do not penetrate the stem end of fresh vegetables to any extent ;

(3) Bacteria do not penetrate the unbroken skin of fruit and vegetables kept under market conditions ;

(4) Pathogenic bacteria may gain entrance through injured or decayed parts, but the spread is to a very limited extent. They have been found alive for from seven to 42 days ;

(5) Pathogenic bacteria may persist on the surface of fresh vegetables, if moist for 15 days ;

(6) Chlorination frees the surface of vegetable matter, but was not effective against cysts or ova ;

(7) Alcohol as a disinfecting agent was ineffective in killing protozoan cysts or ova ;

(8) Potassium permanganate in ordinary strengths was not effective against cysts or ova ;

(9) Burning alcohol on the surface or pouring boiling water over the surface does not allow of sufficient heat in the crevices to destroy all organisms ;

(10) Dipping fruits and vegetables into boiling water for ten seconds appears to be the only method which kills bacteria, protozoan cysts and eggs.

ANNUAL REPORT

OF THE

BRITISH GUIANA SUGAR PLANTERS' EXPERIMENT STATION.

1ST OCTOBER, 1924, to 30th SEPTEMBER, 1925.

STAFF.

Chemist.—Mr. A. D. E. Lauchlan, B. A. of Saint Catharine's College, Cambridge arrived in the Colony on November 19th, 1924, and commenced work on the following day. Mr. Lauchlan took his degree in June 1923, and was engaged the following year in carrying out the analytical work in connection with the soil survey of the fruit districts of the Eastern Counties. This work was conducted at the School of Agriculture at Cambridge and was financed by the Ministry of Agriculture.

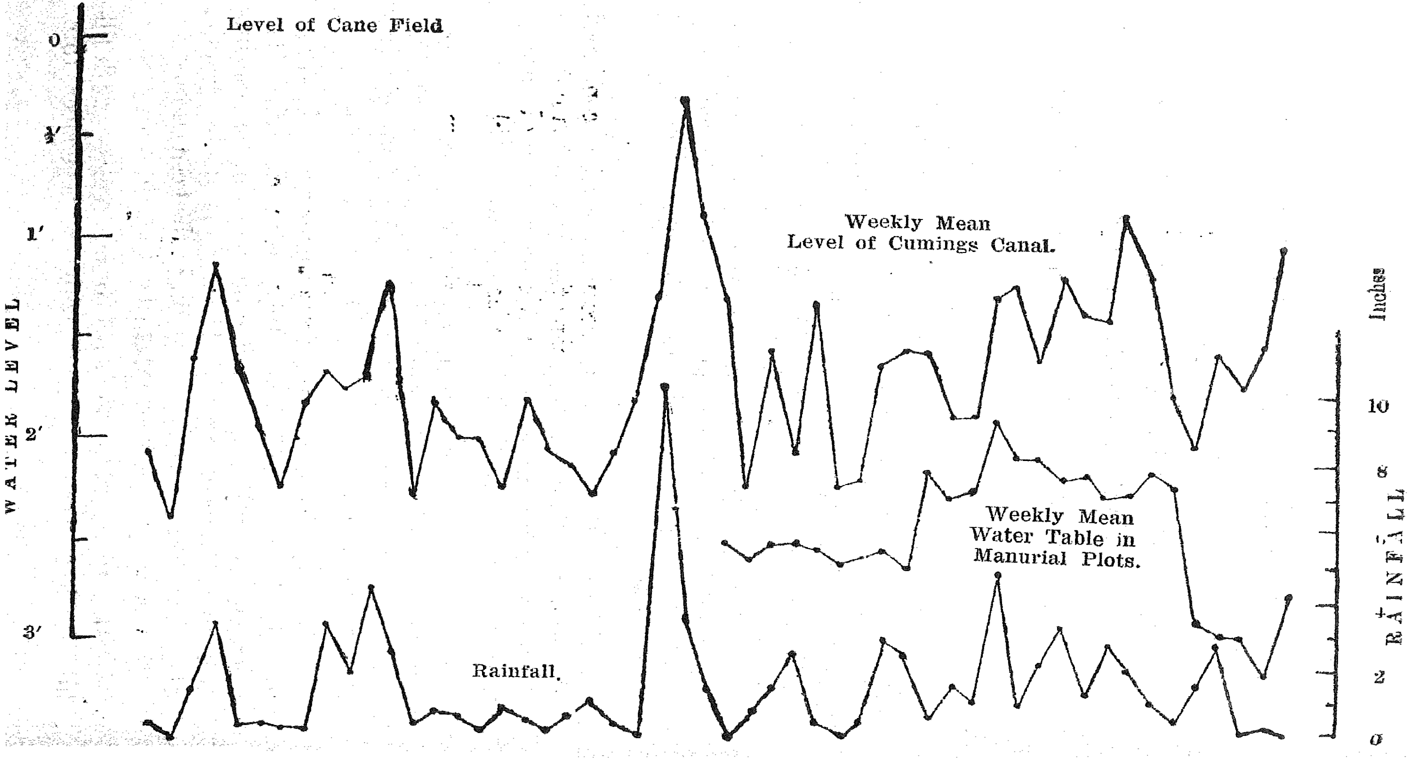
Field Manager. On account of the continued ill health of Mr. J. P. Bastiaans the Station has not had the undivided attention of one Manager for any length of time throughout the period under review.

Mr. Bastiaans was absent on sick leave from November 12th to the 28th, December 15th, 1924 to March 31st, 1925, and from May 12th to September 30th, giving a total of 263 days.

Mr. R. Thomson acted from January 13th, 1925, to March 31st, and from July 14th to July 31st, when he tendered his resignation on accepting an appointment in Goverment Service. There is no doubt that the Station benefited greatly as a result of the keen enthusiasm with which Mr. Thomson carried out his duties.

Mr. C. L. Johnson acted from August 28th till his services were dispensed with on September 15th.

Variations in level of Cumings Canal measured from general level of cane field.



Mr. J. E. Kidman was appointed on probation on September 15th.

It will be seen that for a period of 174 days the Station was without a Manager.

Field Overseer. Mr. C. Cameron has held this post throughout the period under review, and has proved of great assistance, particularly as he was able to carry on the work of the Station in the absence of a Field Manager.

Secretary. Mr. C. L. C. Bourne was absent on leave from April 3rd to September 29th. Mr. J. A. V. Bourne acted as Secretary during this period.

Laboratory Assistant. Mr. A. G. Mc Lean was absent on leave during the month of January 1925, and his resignation was accepted on the 31st. of that month. His resignation was brought about by his election to the British Guiana Scholarship.

Mr. E. S. A. Chin was appointed on probation on January 1st, 1925, and confirmed on the 1st February.

Clerical Assistant. Miss M. Sealy was appointed on October 20th, 1924.

WEATHER.

From an examination of the attached chart it will be seen that the greater part of the rainfall occurred in October and December 1924, in March 1925, and between the latter part of June and the middle of August.

The resulting fluctuations produced in the mean level of the Cumings Canal are clearly shown, the water level being injuriously high in October, December, March and August. The low level at the end of August neutralised the short period of high level at the end of September. Owing to the pumping plant being out of order the Station was entirely dependent on gravity drainage. A certain amount of relief was obtained by drainage through the Navigation Trench and the La Penitence Canal, but this was not sufficient to prevent serious damage to two fields of young plant cane in March.

In March 1925 a device for measuring the height of the water-table, i. e. the level of the permanent ground water was set up in the centre of the Manurial Plots at the Experimental Fields. This consisted of a small well about a foot in diameter and 6 feet deep. A loaded float was attached to one end of a light brass chain which passed over a pulley mounted on a suitable upright, the other end of the chain carrying a counterpoise. This load and counterpoise served to reduce the error caused by the weight of the chain itself. A pointer attached to the counterpoise gave the depth of the water level below the surface of the ground on a suitably graduated scale. Readings have been taken daily since the 1st. April 1925, and the weekly mean levels are shown in the diagram. It is regretted that readings are not available for the wet period in March when the water rose to within 9 inches of the surface.

The waterlogged condition of the field is probably largely responsible for the very small differences found in the Manurial Experiments. Sir John Harrison, who was also of this opinion, attributed the insignificance of liming experiments to the same cause. With heavy clay soils of this type the presence of standing water at a depth of only 2 feet below the surface in the centre of the bed invariably results in the next stratum—a foot or more in thickness-being in a waterlogged condition. This state of affairs can only be remedied by deeper drainage, though it is only fair to point out that the drains of the Manurial Plots are only 9—12 inches deep.

It would be of great interest, and possibly of great value if the Manurial Experiments carried out by Sir John Harrison could be repeated on well drained land.

LABORATORY.

A detailed account of the work carried out in the laboratory at the Experimental Fields will be found in the report of the Chemist, which is appended.

EXPERIMENTAL FIELDS.

MANURIAL PLOTS.

The general arrangement of the plots remains as described by Sir John Harrison in the West Indian Bulletin, Vol. 13, Page 95. The present investigation was planned to obtain information on the following points :—

Series 1. (1) Does the addition of rice straw as a mulch have any appreciable affect on the yield of cane ?

(2) Is sulphate of ammonia definitely superior to nitrate of soda as a source of nitrogen ?

(3) At what rate should sulphate of ammonia be applied to give the most profitable results ?

(4) A comparison of D. 625, D. 145, D. 118.

Series II. (1) Does the addition of potash have any appreciable influence on the yield ?

(2) Does the addition of superphosphate have any appreciable influence on the yield ?

(3) Does the addition of potash and superphosphate together have any appreciable influence on the yield ?

In the second series all plots received the same quantity of sulphate of ammonia as a source of nitrogen.

(4) A comparison of Bourbon, B.H. 10 (12.) Ba. 6032, D.625, D.695 and D.689.

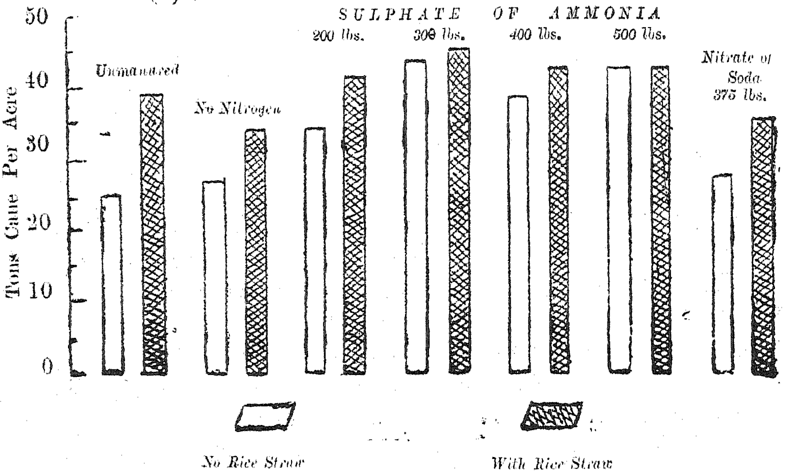
The plots were planted in June 1923, the manures were applied in December 1923 and the plots were reaped in November, 1924.

Series I.

(1) *The effect of rice straw as a mulch.*

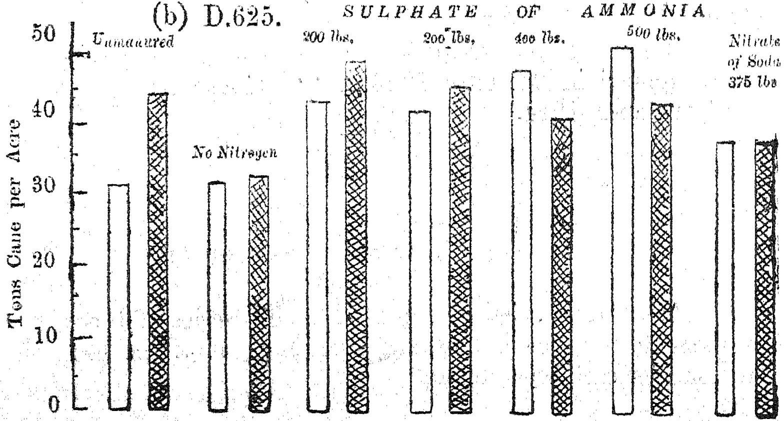
The three varieties employed in this series did not respond to the same extent, and accordingly it will be best to consider each separately.

(a) D.145.



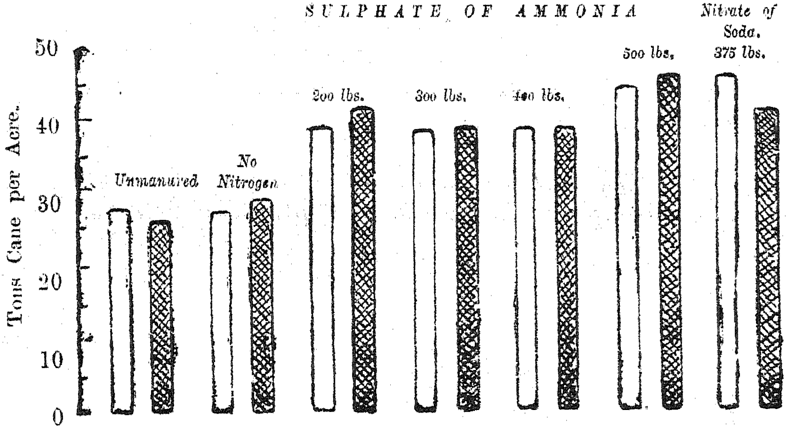
It will be seen from the above diagram that the largest gain is found in the unmanured plots, the plots receiving minerals alone not benefitting to such a marked extent. The additions of minerals would probably have an unfavourable influence on the soil tilth which would not be entirely counterbalanced by the effect of the straw. It is noteworthy that the yield without nitrogen and mulched is equal to that receiving 200 lbs. sulphate of ammonia and no rice straw. The maximum yield is given with the addition of 300 lbs. sulphate of ammonia, and here the mulching appears to have had very little influence.

(b) D.625.



The depressing action of the mineral fertiliser alone is also shown here, but 200 lbs. of sulphate of ammonia to the mulched plot gives as good returns as larger quantities of ammonia to the unmulched ones. It is surprising to find that with large additions of sulphate of ammonia, mulching apparently depresses the yield. This may be due in part to the exhaustion of the soil oxygen by the processes of fermentation of the rice straw, but probably to a greater extent to the loss of appreciable quantities of nitrogen by denitrification, a change which would readily take place in the compact non-aerated and heavy wet soils of this field in the presence of large supplies of organic matter.

(c) D.118.



Comparatively trifling effects are produced by mulching in the case of this variety, and the depressing action of minerals alone is not shown.

2. *Comparison of Sulphate of Ammonia with Nitrate of Soda.*

(a) D.145.

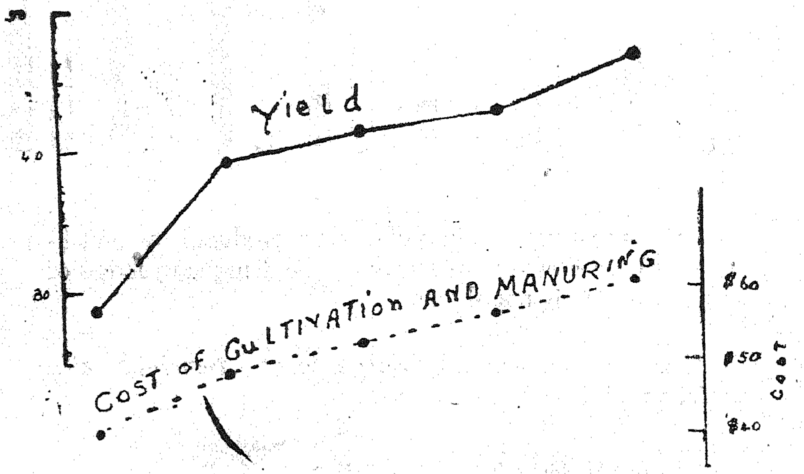
The plot receiving nitrate of soda alone gave practically no increase as compared with the minerals alone in the unmulched, but mulching caused a considerable increase. Undoubtedly we have here a case of destruction in tilth as a result of deflocculation by the alkaline carbonates, the ill effects of which are greatly reduced by the rice straw.

(b) D.625

This shows a slight increase as compared with the no nitrogen plot, but the yield is less than that produced by the addition of small quantities of sulphate of ammonia. There is practically no difference between the mulched and the unmulched plots, the yield in both cases being roughly equal to that given by the mulched portion of the nitrate plot of D.145.

This variety appears to respond to nitrate of soda to the same extent as to a heavy dressing of sulphate of ammonia. This variety does not appear to be influenced by poor tilth.

3. ***The rate at which the sulphate of ammonia should be applied to give the most profitable returns.***



If we assume the cost of cultivation of the unmanured plots to be $40, and taking sulphate of ammonia at $88 per ton, we find that the gain effected with an application of 200 lbs. per acre is as great as that given with heavier applications. It is clear that of the three varieties under consideration D.625 makes the greatest response and this is undoubtedly one of the chief reasons for the success of this valuable seedling.

4. *Comparision of the three varieties, D.145, D.625 and D118.*

It is obvious from the above considerations that D.625 is superior to D.145 and D.118, and that D.145 responds more to improved tilth than D.118.

Series II.

(1) *Potash.*

In only one case was any benefit produced by the addition of potash and this was not confirmed in the parallel plot of the variety, namely Bourbon. This confirms previous experiments which have shown that the heavy soils of the coast land do not, as a rule, respond to the use of potash as fertiliser.

(2) *Superphosphate.*

With the exception of Bourbon all the varieties under trial made a small response to the addition of superphosphate. Of the Bourbon plots one plot showed a decided gain the other two parallels not responding.

(3) *Potash and Superphosphate.*

There appears to be very little advantage in giving a complete fertiliser with the possible exception of the two varieties Bourbon and perhaps Ba 6032 which apparently require rather larger quantities of potash than the other varieties.

Neglecting variety we find that the addition of potash produces a slight gain, that of superphosphate a rather larger one while the additional benefit obtained by supplying both potash and superphosphate is very small. It is probable that on pegasse soils or on clay soils which are well drained and in good tilth these effects would be much more pronounced.

(4). *The Varieties,*

The order of merit would appear to be :—

(1) D.625 ...

(2) B.H. 10 (12)

(3) D.689 and D.695

(4) Ba 6032

(5) Bourbon.

OLD VARIETY PLOTS.

A number of varieties which were previously only in the arrow plots at Sophia have been planted in the Experimental Fields. This collection includes a number of importations from Brazil, some of which have already being tried as parents in the production of seedlings though so far without giving any of great promise.

1924 SEEDLINGS.

The sowing of arrows took place in November. The number of seedlings potted out into baskets by the end of February was 9,902 and the best of these were planted out early in May. These seedlings have undoubtedly suffered greatly from unfavourable weather conditions. The soil was saturated and waterlogged in the early stages and later they have suffered from drought. The wet condition prevailing at first resulted in the formation of a purely superficial root system and in consequence they were greatly handicapped at the commencement of the drought.

Table showing the parentage of the basket seedlings raised in 1924.

Parent	No of seedlings in baskets.	Parent	No of seed lings in baskets.
D.625	1950	Z. Cheribon	19
D.145	1544	Armstrong	12
Mani	1532	Bourbon	9
D.419	1529	D.436	6
D.118	1509	Caiara Roxa	6
Badilla	696	Leonardina	3
B.H. 10 (12)	421	Cayanna	3
Green Transparent	476	Maroue I.	2
D.4397	364	139 Java	1
White Transparent	20	Total	9,902

GREEN MANURES.

Sesbanea aculeata.

The first reference to this plant in this Colony appears to be in the report on the Agricultural Work in the Botanic Gardens for the years 1893-95, where Jenman and Harrison state as follows :—

> "This leguminous plant grows as a weed on the dams and abandoned fields in the Colony. Its seeds, from their composition, are well suited for the food of birds and from their small size if fed to animals without crushing would probably be voided in an undigested state. The interest of this plant lies mainly in its adaptability as a leguminous cover crop for temporarily abandoned sugar cane fields.
>
> It is mainly a seashore plant but spreads inland to abandoned fields and dams. When young and soft the foliage is eaten by grazing and browsing animals, but finally it becomes woody and dried up when it is useful only for kindling. The seed is plentifully shed and lies for several months on the ground, however wet the weather may be, till the period of the year arrives for its germination. The growth is very rapid. It is an annual."

The plant was grown on the green manure plots on the Brickdam Field and also at Sophia but does not appear to have aroused any enthusiasm.

It has been found in India that Sesbanea aculeata, known colloquially as "Dhaincha," is without exception the most valuable green manure plant. Although in general use in all branches of agriculture it has probably proved of the greatest benefit in the tea industry where green manures have now practically replaced Sulphate of Ammonia and Nitrate of Soda as sources of nitrogen.

In the past, the high cost of hand labour and the meagre labour supply of this Colony have proved insuperable obstacles to any proposal for green manuring on a large scale. With the present rapid spread of facilities for mechanical tillage it is probable that these obstacles will be removed in the near future. With the object of gradually providing a stock of seed in the Colony, all the available Sesbanea seed in the neighbourhood of the Station was collected, and amounted to approximately 1000 lbs. Small quantities were distributed to those estates which were in a position to grow it for seed purposes and the remainder was sown on the Station and on the Experimental fields. At the latter the plants sown in February 1925 were 4 feet high at the age of two months, and 14 feet at the age of 8 months.

Crotalaria striata.

Since Sesbanea aculeata suffers from the disadvantage of requiring a good seed bed for the production of a heavy crop the above species of Crotalaria has also been extended. Although its growth is not so rapid and it also forms more wood, Crotalaria will prove of value where difficulty is experienced in obtaining a good stand of Sesbanea. Experiments carried out by Mr. Arnold at Blairmont showed that Crotalaria gave a much heavier crop than did Sesbanea. Mr. Arnold attributed this to the impossibility of obtaining a friable seed-bed at a reasonable cost. Sufficient supplies of seed are not yet available to justify distribution to the estates.

Vigna repens.

In March 1925 Sir John Harrison drew my attention to a leguminous weed which had acquired an aquatic habit growing from the surface of the water at the old bathing pool near the entrance to Sophia. The importance of the discovery of an aquatic legume lies in its value as a green manure plant for flooded land. It was noticed that the plant was not flowering freely although making a vigorous vegetative growth. It was suspected that this was connected with the wet habitat, and accordingly the plant was extended in a drier situation. Since only a small quantity of seed was available this was sown in boxes and the seedlings transplanted as soon as they were large enough to be handled. Quincunx planting was adopted, the interval being 2 feet, and in spite of the wide spacing the plant spread rapidly and formed a dense carpet suppressing both grass and weeds. As anticipated, the plants blossomed freely and several pounds of seed have been collected which will be sown at the commencement of the next rainy season.

Professor C. V. Piper (Senior Agronomist U. S. Department of Agriculture) reported as follows to the Assistant Government Botanist with reference to this plant :—

"Your No. 100 is ***Vigna repens***, a highly variable species which it may be possible to split up into a series of varieties. It is abundant in some places in this country and we have experimented with it as a crop, but in regions where it is not native the results have been indifferent. I see no reason why it should not be an excellent green manure crop particularly if the seeds can be gathered cheaply enough.

I am calling this ***Vigna repens***, as there seems little doubt that the ***repens luteola***, and one or two other names may represent the same species. Apart from the little experimenting we have done with the species I do not find any records of experimental work."

DRAINAGE.

In dealing with the weather conditions prevailing during the period under review reference was made to the water-logged condition of the manurial plots. The drainage water from the Experimental Fields flows down a trench on the Southern side of the Botanic Gardens and thence down the Croal Street trench. Owing to the Lamaha Canal and the Sophia navigation trench separating the Experimental Fields from the Station it is not possible to make use of the Sophia drainage system, without the installation of an aqueduct of which the cost would be prohibitive. There is no doubt that the trench in Croal Street is overtaxed in heavy weather and that the installation of a pumping plant to maintain the Croal Street trench at a reasonable level would be justified by the improved conditions that this would produce in a large residential area, apart from the great benefit which would be reaped by the Station. The installation of a small pumping plant at the Laboratory would greatly improve conditions at the Experimental Fields, but unfortunately this would probably cause the Croal Street trench to overflow in heavy weather.

SOPHIA.

SEEDLINGS.

1922.

A field selection was made by Mr. Bastiaans in October, and a second selection by Mr. Thomson in January. Samples of the selected canes were analysed. On cutting these fields for grinding an exceptionally stout cane was found which had been missed in both inspections. As the first three canes cut weighed 22, 20 and 19 lbs. respectively it would appear that complete reliance should not be placed on a system in which the first selection is dependent on field inspection. 157 varieties were extended in Field No. 5 W. As a result of the exceptionally heavy rains in March and the resultant long continued waterlogged condition of this field a large proportion of the plants died. In June the survivors were replanted in

No. 4 W. as stumps, so as to reduce the area under cultivation, and at the same time maintain a normal planting distance. This involved a loss of 29 seedlings.

1923.

254 of these were selected and planted out in Field 4 W. The exceptionally heavy weather in March resulted in a loss of nearly 60 per cent of these, 109 now remaining in cultivation.

1917, 1919, 1919, & 1920.

A number of these were extended from the last Section and planted in Fields 6-9 W. inclusive. This selection was conducted by Mr. Bastiaans and depended entirely on the appearance of the cane in the field.

It is to be regretted that more complete data was not available with regard to both the tonnage of cane per acre and the sugar content.

CHLOROTIC MOTTLING OF B. H. 10 (12) AND BA 6032.

Early in October the peculiar appearance of the abandoned plots of these two varieties in Field 12 W. was first noticed. The plants were extremely stunted and the leaves presented a suspiciously mottled appearance in addition to being extremely pale in colour. The plants were inspected by Messrs. Cleare and Altson who expressed the opinion that the canes were probably suffering from Mosaic Disease. The necessary steps were then taken to bring the matter to the notice of the managers of those estates which had received cuttings of those two varieties. In the majority of cases it was found that the two varieties had not given satisfaction where the planting material could be traced back to these particular plots. In a few cases growth had been so unsatisfactory that the varieties had been already thrown out of culivation as being of no value. Wherever healthy B. H. 10 (12) was found with a dark green foliage further enquiry showed that the planting material had originally been obtained from some other importation.

From enquiries made as to the antecedents of the original importations in 1920 it would appear that these are open to grave suspicion. The exporters state :—

> "These two lots however, did not come to us direct from the Plantation but through the Manager's Agent in town, a Mr. E. C. Hill. This Agent owns or leases a portion of what was many years ago known as Kensington Pln. on the Western outskirts of the town. Only a small portion of the lands is now under cultivation, the remainder being built over or in Tenantry. We know that Mr. Hill had some canes on these lands at the time because he spoke of them to us as being very vigorous and healthy, and it is just possible that some of his plants were included in those delivered from "Frazers" but he kept no record and does not remember whether this was so or not.
>
> At the time of our shipment there was no suspicion of Mosaic Disease, the first appearance of which was reported to the Government by the Agricultural Department on the 27th October, 1920. In May 1922, however, Mr. Hill's fields were found to be infected and he was made by the Government to destroy four acres. He has planted no canes on the land since.
>
> In view of the foregoing it is not impossible that so m plants from Hill's lands were included amongst those shipped and that the source of infection may be traced to them. Mr. Hill tells us however, that he sold a large quantity to St. Vincent from the same lands and that no complaint has reached him about these.

Mr. Altson in later reports expresses the opinion that the canes were not suffering from Mosaic Disease.

No matter whether the disease in question was actually Mosaic or some other form of chlorosis there is no doubt that this particular stock was not in a normal state of health and, consequently, that the precautions taken were justified.

DISTRIBUTION.

Apart from the few varieties distributed early in October on a selection carried out by Mr. Bastiaans, no seedlings have been distributed to the estates. It was found that insufficient was known as the value of the seedlings under cultivation and later it was feared that indiscriminate distribution might result in the spread of the chlorotic mottling described above.

EXPERIMENTS IN UNDER-DRAINAGE.

The system of broad open drains which is universal on the estates probably presents one of the greatest obstacles to the use of mechanical implements for intertillage between the rows of canes. The open trench system has the further disadvantage that it excludes quite a considerable area from cultivation. In Upper Assam a system of covered drains has proved satisfactory and comparatively inexpensive, though labour there is very much cheaper than it is here. These drains were constructed as follow :—

(1) A trench was dug 1 foot wide and 2 feet deep.

(2) A trench 6 inches wide and 2 feet deep was dug at the bottom and in the centre of the first trench.

(3) A layer of bamboo matting was laid along the shoulders so made as to form a lid to the narrow trench.

(4) The sub-soil removed in digging the narrow trench was then placed on top of the matting and the first few inches well tamped by treading. The broad trench was then filled in completely.

It was found by experience that covered drains of this type still functioned after 10 years in heavy soils with a rainfall of 100 to 110 inches, of which the greater part fell between the middle of June and the end of September

Three beds in Field No. 12 W. were drained in this way, but unfortunately the drains were not covered in as fast as they were constructed and this resulted in the shoulders which had been exposed to the weather cracking and subsiding to a certain extent. In spite of this and of the fact that the ungraded side line resulted in the bamboo matting being under water for the greater part of the year, this plot was obviously better drained than any other area on the Station. Had the side line been graded, and the water level maintained at a lower level than that of the matting (which was only 18 inches below the level of the bed) still further benefits would have been obtained.

The cost of constructing drains of this type by hand is so great that the system cannot be adopted under ordinary estate conditions. The cost of excavation could be reduced considerably by performing this operation mechanically by such an implement as the Revolt Excavator. The following description of this implement is taken from the Journal of the Ministry of Agriculture, Vol. 26, P. 1082 (Feb. 1920)

> " The U-shaped share serves to scoop up a layer of the soil; the loosened soil enters the lower part of the inclined conveyor that carries it to the top of the machine where a discharge chute returns it to the ground on the side of the trench. An adjustable shoe in front regulates the depth of the cut. The conveyor is driven direct by the combined cog and carrying wheel that runs along the bottom of the ditch. It is understood that near Boston, Lincolnshire, working in light loamy soils the machine with a Fordson tractor cut 100 yds. 3 feet deep in half an hour.

The rate of working in a wet clay soil is not appreciably reduced. As only 6 inches can be taken at each cut, progress would be much more rapid with several machines in tandem though this would require a larger power unit such as the Holt tractor or the Fowler cable tackle. This excavator has already been tried successfully in this Colony but was found to be too light and flimsy.

In May 1925 I was informed by the South Lincolnshire Engineering Co., that they were starting construction on a new model which is to be heavier and more robust, and free from projecting bolts and studs which in the old model scored the wall of the trench and increased the friction unduly. This firm is working in co-operation with Messers. Marshall of Gainsborough and there appears to be every likelihood that they will produce a satisfactory implement.

It is quite likely that a cheaper substitute could be found for the bamboo matting used in Assam. Rough flat tiles might be made from the heavy clay found on the front land, which could be burned in a stack kiln. It must be borne in mind that a narrow trench 2 feet deep is equivalent to a circular tile drain 18 inches in diameter. In the early experiments on tile drainage carried out at La Penitence, inadequately small tiles were used 3 inches to 4 inches in diameter, a size which is only used at the present time in England where the rainfall is one third of that experience here. The late K. J. Mackenzie of the Cambridge School of Agriculture was of the opinion that with a rainfall of 80 to 100 inches tiles at least 8 inches in diameter would be required.

Drains of the "cut and cover" type constructed in the forties in peat are still giving satisfactory service after 80 years. Here the cover was made from dried peat turves which were well rammed. A similar type of drain might prove satisfactory on pegasse soils.

DEMONSTRATION OF THE ROTOTILLER.

In April 1925 the first Rototiller to arrive in the Colony was kindly lent by Messrs. Davson & Co., to the Station for trial and demonstration. As the bearings had not been run in, the machine was stiff and did not develop its full power, but, in spite of this the machine developed a very good tilth, such as could only be obtained with any other implements on the heavy clay soil at Sophia by a long series of tillage operations which would have to be carried out under optimum weather conditions.

At the demonstration some of the planters feared that the machine would be too small and light for serious work on estates. A larger machine could not be used for intertillage in the cane field, and its lightness is really a great advantage since this facilitaties transportation from field to field. Experience has shown that with fair treatment (lubrication etc.) it will give continuous service, the quality of the work improving as the bearings get run in.

Reference must be made to the work carried out by Mr. Waterfield with the Rototiller at Pln. Marionville.

His experiments with one machine gave such promising results that three more machines were imported. No attempt was made to make covered drains, small wooden bridges being used to enable the machine to pass from bed to bed. In spite of the expense incurred in moving these bridges, the cost of cultivation was reduced to a very small fraction of that entailed by hand labour. The actual reduction of expenditure is comparatively of much less importance than the very great improvement produced in the quality of the work and consequently in the tilth. The saving in man power, that is the number of labourers employed per acre per annum, is an aspect of the problem which is of very great importance in this Colony with its very limited labour supply.

Apart from the improvement in the tilth produced by better cultivation, further benefits are to be looked for since this machine will render it possible to place large areas under leguminous cover crops such as Sesbanea and Crotalaria, and further to incoporate these with the soil. The Rototiller has successfully turned under crops of mustard standing 3 to 4 feet high.

I understand that a fleet of Rototillers have been ordered for Pln. Blairmont and I have no doubt that Mr. Waterfield will be pleased to answer any enquiries as to the capabilities and performances of these machines. Of course with the Rototiller as with any other implement the personal element must be taken into account, one man succeeding where another fails.

SPACING EXPERIMENT.

Upon the recommendation of Sir John Harrison three beds in Field No. 4 W. were planted out with D. 625 in the month of June at various interplant intervals. Sir John Harrison was of the opinion that an excessive number of tops per running rod were planted on the estates. Though this might reduce expenditure on supplies, it was largely responsible for the poor spring which was probably due to the selection of plantin material being insufficiently strict. Where a large quantity of planting material is required it is obvious that the same degree of discrimination cannot be applied in selecting the tops.

In this experiment the tops were planted at 36, 24, 18, 15, 12, 9 and 6 tops per row respectively, four rows for each spacing constituting a plot ; it was found possible to plant six series of plots, and since the produce from each individual row will be weighed separately, 24 observations of each spacing will be obtained.

"*THE JACKPAN.*"

A new implement called a "Jackpan" was received from Messrs. Booker Bros. for trial.

> "The Jackpan is not unlike a pick with a long handle and one blade which at the end broadens and flattens out into a chisel-like edge. The second blade is replaced by a wide, pear shaped disc. In use as a pan breaker or cultivator the Jackpan is driven into the ground like a pick. So great is its penetration, thanks to the scientific design, that only in the very hardest soil is more than one blow required to bury the blade. An upward pull on the handle causes the blade to rotate about the fulcrum formed by the disc, thus shattering the surrounding soil in a way that must be seen to be fully appreciated."

Unfortunately the labour in this Colony is not accustomed to handle the hoe so that the same degree of success was not obtained here with this implement as compared with the results obtained in the East. Nevertheless for one particular operation it was found to be of very great value, namely in opening up the soil after wet weather—"subsoil drilling." This has been satisfactorily carried out at the rate of one cent per row per bed or $2.40 per acre, both banks being drilled.

The implement is substantially made and should have a long life. It is estimated that the cost would range from $1.08 to $1.20 each according to the quantity required.

GENERAL.

EXHIBIT AT THE ESSEQUEBO AGRICULTURAL SHOW.

The space allotted was situated on the North West corner of the show ground. The accommodation provided consisted of a large notice board 12 feet by 8 feet, a covered stall, and a small area of land enclosed by a fence for demonstrating a covered drain and a manure pit.

The notice board, which was covered with black cloth served for the display of a map of the Sophia Experimental Station on the scale of one inch to the rod, a set of four diagrams illustrating the construction and use of the Rototiller, and a collection of varnished canes.

On the back of the notice board were shown three diagrams giving :—

(1) The mean annual production of sugar in the Colony over periods of five years from 1826 to the present time.

(2) The areas occupied annually by the Bourbon and D. 625 varieties since 1902.

(3) The areas occupied annually by a number of seedlings and imported varieties since 1902.

Immediately in front of the notice board were found a number of young seedling canes in baskets and a box of still younger seedings. The latter served to illustrate the efficacy of the method devised by Sir John Harrison for raising seedling canes, the growth resembling that of a grass lawn.

On a table in the covered stall were arranged a number of experiments connected with soil problems. Prominent amongst these was a brass tube about four inches in diameter and slightly tapered. This, the Kopeczky soil sampling tube, is designed to enable a sample of the soil to be taken with the minimum disturbance. It has the lower edge sharpened to facilitate entry into the soil and is provided with lids which serve to close both ends tightly.

A gauze cover was also shown which could be interchanged with the lower cap.

An experiment in which use was made of these tubes was on view. Samples of soil, which had been taken with the minimum disturbance from under-drained and surface-drained plots, were shown to have widly different properties as regards the percolation of water. On pouring equal volumes of water on both samples the under-drained soil offered very little resistance to the penetration and passage of the water, while the surface-drained sample remained covered with water for a considerable period. The water dripped very slowly from the latter sample, but flowed rapidly from the under-drained one. This experiment was greatly appreciated as being a very satisfactory demonstration on the improvement of the soil brought about by under-drainage.

Another Kopeczky tube containing a mixture of ordinary clay soil and artificial farm yard manure shewed the great improvement in the texture of the soil produced by the addition of organic matter.

In the centre of the table there was a large stand supporting eight graduated glass tubes. Four of these dipped into a trough containing water, and the other four were suspended above the trough, the lower ends of the tube were closed with muslin covers. The tubes were filled with Fine Gravel, Coarse Sand, Fine Sand, and Clay, respectively. It was seen that the water rose to the greatest height in the tube containing Fine Sand, (owing to the small size of the capillaries.) The ascent of the water in the clay was so slight that it was barely visible. The downward movement was most rapid in the coarse grained soils, while in the clay the water only penetrated to the depth of an inch, though the experiment had been started the previous evening.

A young cane sett growing from a single node was shown to illustrate how it was possible to economise in planting material with the object of securing a more careful selection of tops.

In the enclosure a trench 18 inches wide by 18 inches deep had been dug. At the bottom of this trench, and in the centre, a second one had been cut 6 inches wide and 18 inches deep, on the shoulders so formed a bamboo mat was laid, and a portion covered in with soil. This illustrated the method of under-drainage successfully developed by Mr. John Pringle on the Pabbojan Tea Estate in Upper Assam, where it was found that drains prepared in this way continued to function for more than 10 years. A poster was displayed drawing attention to the advantage of under-drainage and giving a rough estimate of the probable cost of this method. Specimens of matting were also on view.

In a pit alongside was shown a sample af Artificial Farmyard Manure prepared from waste cane, trash and other vegetable debris. The material consisted of a soft friable porous mass scarcely showing any of the original structure of the cane, etc. The nitrogen content of the moist material was 0·31 per cent, which compares quite favourable with the ordinary Farmyard Manure or with that made by the Adco process. It is probable that the favourable type of fermentation is largely due to the presence of alkali in the subsoil waters.

Brief demonstrations were given at intervals throughout the day and appeared to create considerable interest, judging from the number of enquiries made, by cane farmers in particular.

LECTURES.

A lecture entitled "The Aims and Object of the Sophia Experiment Station," illustrated with lantern slides was given at the following centres :—

Diamond
Leonora
La Bonne Intention
Blairmont
Port Mourant
Hampton Court
Marionville
Wales
Uitvlugt

A lecture entitled "The Plant Root and Its Environment" was given at the same centres with the substitution of Schoon Ord for Wales.

VISITS TO ESTATES.

Visits have been paid to estates at intervals but frequent changes in the managment of the Station have made it inadvisable for me to be away from the Station more than was absolutely necessary.

The most striking change during the last two years is the large increase in the number of outfits for mechanicial tillage. These are in the main designed for the periodicial deep ploughing before planting, the Killifer and the Rototiller being the two chief exceptions.

There is one direction in which estates equipped with pumping plants could effect a very great improvement in the soil conditions. As a result of the insistance on every possible economy being practised in view of the depressed condition of the sugar market, pumping plants are only worked to prevent the water in the sideline actually flooding the front fields. Consequently for long periods on end water may be seen standing up to within less than a foot of the beds. This inevitably results in the front fields remaining in a waterlogged condition and hence providing extremely unfavourable conditions for the growth of the cane.

If it were possible to maintain the water level at a reasonable depth, say three feet below the beds, by running pumps for longer periods it is extremely probable that the increased expenditure would be a profitable investment as a result of the increase in the yield of the cane and in the sugar content.

As a result of the improved conditions it would be found that the soil could be tilled more easily, that the canes themselves would have a larger and deeper root system and so be better equipped to withstand a period of drought.

OFFICE.

A card index of the seedlings at the Station has been compiled. On each card, information is given as to the location of the seedling, as to its cropping power and also its analysis. In compiling this index it was brought to light that in a number of instances the same number had been applied to different seedlings. With the aid of the card index it will be possible to obviate the confusion which would have been brought about if this had not been discovered. A card index of scientific articles concerning the work carried out at the Station and at the Laboratory has been compiled and will be kept up to date from time to time. Typewriters have been purchased for the use of the Chemist and the Field Manager.

SALE OF CANES.

371 punt loads of cane were forwarded to Pln. Ogle. and these gave 89 tons of sugar. The Station received $4,050.78 as a result of the transaction.

	Acres	Punts	Approx. sugar per acre.
Sophia Station, Cultivated	47.57	293	1½ ton.
,, ,, Abondoned	16.82	50	¾ ,,
,, ,, Total	64.39	343	
Experimental Fields, Cultivated	3.33	25	2 ton.
Experimental Fields, Abandoned.	2.50	3	¼ ,,
,, ,, Total	5.83	28	
Grand Total	70.22	371.	1¼ ton

COMMITTEE.

At the commencement of the period under review the personnel of the Committee was Sir John Harrison C.M.G. (Chairman) Hon. Mr. R. E. Brassington, Messrs. G. E. Anderson, A. E. Craig, R. Strang, P. H. Edwards and C. Farrar, the two last named being locum tenens for Messrs.

D. Clarke and W. M. B. Shields respectively. The Planters Association re-elected the retiring members Messrs. Strang, Clarke and Shields as from 1st January 1925.

Mr. R. P. Daggett acted for Mr. Anderson from April to the end of October, whilst Mr. W. S. Jones acted for Hon. Mr. Brassington from June to October.

At the September meeting it was decided to levy an assessment at the rate of 24 cents per acre during the forthcoming year.

A statement showing the total Receipts and Expenditure for the year ending 30th September, 1925 is appended.

C. L. WHITTLES,
Superintendent.

* * *

BRITISH GUIANA SUGAR PLANTERS

Statement Showing Total Receipts and Expenditure

RECEIPTS,

Balance 1923-24	$ 3,080.96
Assessments on Sugar Estates 1924-25	21,828.40
Government Contribution in lieu of assessments on Cane Farmers...	1,000.00
Interest on Savings Deposit ...	216.07
Sale of Produce	4,050.78
Other Sales	11.58
Refunds	615.56
	$30,803.35

EXPERIMENT STATIONS COMMITTEE.

for the Year ending 30th September, 1925.

PAYMENTS.

MANAGEMENT.		
Chairman	$1,000.00	
Secretary	580.00	
Superintendent (Salary)	3,380.64	
" (House)	600.00	
Chemist	3,136.53	
Field Manager	2,599.03	
Chemical and Botanical Assistant ...	546.00	
Field Overseer	864.00	
Clerical Assistant	364.39	
Travelling	943.29	13,013.88
SOPHIA STATION.		
Wages.		
Buildings, Bridges, etc.	25.62	
Nursery	566.69	
General Cultivation	2,654.80	
Manuring	97.18	
Reaping, Transporting & Distribution	1,165.99	
Pests	507.66	
Canals and Paths	327.48	
Navigation and Drainage ...	123.48	
Irrigation	23.08	
Miscellaneous	853.01	6,345.39
Expenses.		
Rent and Insurance	1,134.50	
Buildings, Bridges, etc.	8.72	
Manures	171.33	
Reaping, Transporting & Distribution	202.44	
Navigation and Drainage... ...	12.78	
Irrigation	28.30	
Miscellaneous	124.72	
Office and Laboratory	2,128.63	
Contingencies	207.85	4,019.27
TOTAL PAYMENTS		23,378.54
Balance in Barclays Bank Savings Deposit		6,494.91
Balance in Barclays Bank Current Account		879.90
Petty Cash on hand, Field Manager...		25.00
Petty Cash on hand, Secretary ...		25.00
		$30,803.35

THE REPORT ON THE LABORATORY FOR THE YEAR ENDING 30TH SEPTEMBER, 1925.

STAFF.

The Staff of the laboratory, apart from the Chemist and his assistant, consists entirely of government apprentices. By the kind permission of the late Chairman it has been possible to employ these boys for all the routine work of the laboratory.

The number of apprentices employed at the laboratory depends on the nature of the work in hand, a large number being required when sugar analysis is being performed.

Much credit is due to them for having unfalteringly remained at work, which being of a routine nature, presents but few attractions. When it is considered that the work was quite new to them all, and not one of them had had any scientific training, it is gratifying to find keenness, interest and careful work so patent.

In only one case was a boy found to be unsuitable for the work. Below is appended a list of the names of the apprentices and the periods during which they worked at the laboratory. It will be noticed that one or two boys have only been employed for a few days, the reason being that these boys were required to fill vacancies caused by illness or some important business.

The boys are required to attend lessons, model gardens, and carpentry instruction, and these arrangements have also caused them to be absent for varying periods.

NAME	TOTAL DAYS.	NAME	TOTAL DAYS.
M. Lall.	193	J. B. Low	17
R. Hoppie	60	J. Pile	16
P. O. Jackson	58	J. Adams	5
H. Persaud	39	W. Jaundoo	2
W. Bovell	24		

EQUIPMENT.

BUILDINGS. Previous to March, 1925, the buildings of the laboratory only consisted of a mill room and a small room adjoining, which was reserved for the polarimeter and the writing up of the results. This room is also used by the Experimental Fields Overseer.

As the accommodation was quite inadequate for a reasonable amount of work to be done, the adjoining tool shed was incorporated with the laboratory by the removal of a partition.

This extra space being far removed from the engine was almost free from vibration, so that all weighing and preparation of solutions are now performed there.

A large number of shelves, which have been made from packing cases, have been fixed as there was no accommodation for bottles and other pieces of apparatus.

Two new benches were made and one removed from the mill room, being found more useful in the laboratory proper.

MACHINERY.

The original engine used for driving the mills was an experimental alcohol engine made by Messrs. Tangye. This engine was at least 25 years old and in such a worn out condition that a man was required to attend to it continually when running. Running periods appear to vary from ½ an hour to 4 hours, and this uncertain state of affairs appears to have existed for a long time judging from the stoppages recorded in the milling book. The engine finally broke down altogether in November and was pronounced by the government engineer to be quite incapable of doing any work.

An estimate for repairs was drawn up, but it appeared that the cost of such repairs was at least one third the cost of a new engine.

A new engine, a four stroke 10 h.p. oil engine by Messrs. Crossley, was therefore purchased and put down in March 1925 and has given the greatest satisfaction.

The engine is arranged to start on petrol and when warm to run on paraffin. This dual arrangement of fuel allows of easy and quick starting; the starting time for the new engine being approximately 30 seconds as against half an hour for the old engine.

The mill, which was driven by the engine, was about 25 years old, but having done no serious work was in fair condition, the brasses were only slightly worn.

Owing to the small capacity of the mill, it was decided to purchase a second mill. The mill was installed as No. 2. mill and was driven from the same shafting. In the event of a break down of either mill it is possible to grind at least 50 per cent of the normal number of canes by one mill alone.

A supply of low voltage electricity was required for working various pieces of apparatus in the laboratory, and a 6 volt 60 watt generator and a 80 ampère hour battery was installed. This plant is identical with that supplied on motor cars for their lighting equipment. The dynamo is driven by a belt from the flywheel of the engine so that when the mills are running the dynamo will supply current at a negligible cost as the power required to drive it is very small.

A lathe, made by C. A. Vandervell and known as the Wade Lathe, was purchased with a complete set of tools, and has already justified its small cost by the amount of apparatus that has been made on it.

With this equipment the laboratory has very seldom to rely on outside help for making apparatus.

APPARATUS.

The only heating apparatus found in the laboratory was a small spirit lamp, which was quite useless for heating large vessels.

As power alcohol appeared to work well in the Barthel spirit bunsen burner and was cheap, it was decided to adopt this as the standard method of heating throughout the laboratory.

A small copper pipe was laid round the bench and the burners attached at T pieces as with gas.

The heat of the burner is good and steady, and the arrangement indicated above has nearly all the advantages of gas.

In order to keep the temperature of the laboratory as low as possible while soil work is in progress, a small corrugated iron shed was set up opposite the laboratory (this shed had originally been built by the late Superintendent at the back of the laboratory) and a battery of Barthel burner was set up there for the ignition of soil fractions.

A hot air oven and also a hot water oven together with a water bath have been installed there, so that there should be no danger of fire in the Laboratory when ovens etc. have to be left going overnight.

When the alterations were made to the building in March 1925, a high pressure water supply was arranged for use in connection with a filter pump.

This water supply consists of a 100 gallon tank supported on a wooden tower about 20 feet above the ground. Water is pumped into this tank from a 1000 gallon tank at the base of the tower.

Rain water collected from the roof of the building is stored in these tanks and supplied to the sinks by means of a pipe running the length of the building.

In order to keep the speed of the milling and the the sugar analysis constant, a special clock was made in the laboratory and set up above the mills. At a point near the door where the mill driver stands is an electric counter and alarm.

The clock is arranged to send an electric current to the alarm and counter every three minutes or any other desired period, so that a signal is given when another sample of canes is to be fed into the mill. As a further check, the electric counter shows the correct number of the sample which is supposed to go into the mill at the given signal.

The driver has complete control over his people, and thus relieves the chemist of much of the detailed supervision of the milling.

This system has been found to work exceedingly well.

There was originally in the laboratory a small rough chemical balance which has been used for making up solutions of approximate accuracy, and for the weighment of soil fractions.

When a large number of samples have to be weighed this type of balance is unsuitable for heavy loads and also causes a great loss in time.

A semi-automatic balance was purchased from Messrs. Avery Ltd., which is suitable for weighing betwen 0 and 5 Kilos with an accuracy of ½ Gramme.

The balance consists of a set of unbalanced pans and the scale reads from 0—100 grammes. The object to be weighed is placed on the pan, and if less than 100 grammes indicates directly on the scale the weight, but if heavier than 100 grammes, a 100 or 200 gramme weight is placed on the opposite pan, so that the pointer then indicates the odd number of grammes.

Where a large number of similar weighments have to be made it is only necessary to record the difference shown on the scale.

It has been found that 144 samples can be weighed and the weights recorded by one person in less than 15 minutes.

The balance is of particular use when the moisture content of soils is to be determind as the sample has little time to change in weight while the weighment is being performed.

It has been necessary to order a certain amount of apparatus as the amount already in stock was found to be insufficient for the work in hand.

The Westphal balance in use was found to be inaccurate and it was fortunate that there was a spare available. The cause of the trouble is uncertain but it would appear that the knife edges are worn and require grinding.

An improvement has been effected in the use of the polarimeter. Formerly it was necessary to darken the whole room and to place an oil lamp on the opposite side of the partition separating the laboratory from the mill room. It will easily be understood how inconvienient this arrangement was.

A large packing case was treated with a dull black paint both inside and out, and the polarimeter was clamped firmly before a ground glass window in the end of the box. A small motor car bulb was mounted outside the box in front of the window and protected from damage by a tinned iron cover.

A second lamp was placed in the roof to illuminate the scale and also to afford light for the operator while pouring the juice into the instrument.

The lamps are controlled by a two-way switch so that either lamp can be used but not both at once; finally there is a black curtain nailed on the outside to keep out the light which would pass in round the shoulders of the operator.

It might be advantageous to install a small ventilating fan, though the time spent in the box is small as the readings can be taken with great rapidity owing to the improved illumination.

The determination of glucose has been arranged so that there is very little left to the judgement of the assistants.

The solutions are supplied from automatic burettes and pipettes so that it is almost impossible for too much or too little of the reagent to be used by mistake.

The heating of the glucose flasks is by spirit burners. As these burners give a very constant heat the error caused by variable times of boiling is minimised.

In order to allow of rapid weighing of the cane samples an iron cradle was hung up on the hook of a spring balance (the balance being corrected for the weight of the cradle). The mill driver has only to pick up the bundle place it on the cradle when the weight is indicated on the scale. The megasse is collected in small baskets and weighed on a spring balance; however here it is necessary to make an allowance for the weight of the basket, as a correcting factor could not be applied to the balance owing to the varying weight of the baskets.

The following account may perhaps give some idea of the system employed in the milling and analysis of the samples.

The samples which have been brought to the laboratory on the previous day are laid in numerical order, so that there shall be no loss of time in finding a missing sample. The mill driver weighs the sample of cane, recording the number and weight of the sample in a carbon duplicate book, unties the bundle and secures the wooden label to a zinc pan by means of a wire. At a given signal from the clock the canes are fed into No. 1 mill and the pan placed beneath the chute.

As soon as all the megasse has passed out of the rollers, the pan and the basket are removed to No. 2 mill where the process is repeated. In the meantime No. 1 mill has started on the next sample and the cycle of events is repeated.

A portion of the juice is filtered into a Winchester Quart and allowed to stand for an hour before sampling to allow all the bubbles to come to the surface. (The mills start an hour in advance of the analysts to avoid wasting an hour).

A second label is attached to the bottle bearing the same number for future identification as the wooden label is removed when the sample of liquor is taken out for analysis.

The sample passes first through the hands of the attendant who is determining the specific gravity, then to another who clarifies a small quantity for the determination of glucose and sucrose.

This latter sample passes first to the glucose determination where a small quantity of clarified juice is removed and the remainder is passed on the polarimeter.

Each worker has a carbon copy book, a page of which will take 20 entries. As all the attendants work at approximately the same speed, it is possible to collect the sheets from all the books as soon as 20 determinations have been completed, and thereby write up and check the analyses as the work progresses.

In the event of a sample being doubtful, a repeat can be performed as the bottle has still a label attached, but if the figures are found to be normal the sample can immediately be poured away.

By this method it is possible to finish all the clerical work the same day so that it can be decided what number of extensions can be allowed for whilst cane cutting is in progress.

The apparatus in connection with soil analysis may come under two headings :— Physical and Chemical.

In connection with the tilth experiments the Kopecky soil sampling tube requires a little explanation. It consists of a slightly tapered brass tube with the lower edge sharpened, and two tightly fitting lids. When it is required to immerse the tube in water for saturating the soil, the bottom lid is replaced by a tight fitting lid whose centre is replaced by a gauze. A set of 1 dozen of the tubes were purchased and have provided much valuable information. A detailed description of the technique will be found under the heading of Work Done.—***Soil Analysis.***

A small sampling augur (split tube pattern) was made locally and is used in the soil surveys. The method of using this augur is too well known for any further explanation.

The beaker method of mechanical analysis which is the official method has been adopted here and it was necessary to procure beakers and sieves 100 meshes to the inch early in the year as the laboratory was without them.

A dozen sieves were sent out from Cambridge, but later it was found possible to procure a good quality 100 mesh gauze locally, since then all sieves have been made in the laboratory.

A set of sedimentation vessels were ordered in connection with the Krauss method of soil analysis, the apparatus for which is in course of construction. When dealing with heavy clays it is not possible to obtain a complete dispersion by trituration alone, and it has been found that vibration of the soil suspension after trituration will effect this.

Accordingly some some small glass jars with celluloid caps were obtained in readiness for when the Krauss apparatus should be finished.

A supply of chemicals and small pieces of glass apparatus have been ordered for use both in connection with sugar analysis and soil work.

The p.H. apparatus, the parts of which were purchased by the late Superintendent, was found to be slightly out of order. It appears after overhauling that this apparatus will be quite satisfactory as soon as it is possible to obtain the necessary reagents for this class of work

WORK DONE.

SUGAR ANALYSIS.

The first milling season of the year commenced on September 29th 1924 and terminated on February 25th, 1925. As has already been stated the old engine broke down finally in the middle of November, 1924 and all subsequent milling was performed on a small hand mill. It will be understood that this change caused a great loss of time as well as loss in accuracy due to the varying speed of milling on the hand mill.

During the season September to February 1915 samples of cane were analysed as compared with 359 for the whole of the previous year.

The interim period March to September was occupied in reorganising the laboratory in preparation for the next seasons grinding.

The September season commenced on the 15th, inst. and up to the end of the month 690 samples had been analysed. The report of the results of the September 1924 to February 1925 season will be found under the heading of Seedlings. The labour employed for the September 1924 to February 1925 seasons consisted of four men to turn the mill and one driver.

With two mills it has been found necessary to augment this staff and the total number of hands employed is now 7. The driver in addition of his duties of controlling the mill hands is required to weigh the samples of cane and megasse. As far as possible creole labour has been employed both in the case of driver and the mill hands.

Two creoles are required per mill to feed the canes and to receive the megasse, and one creole to fill the Winchester Quarts from the pans.

As the attendents have to give their undivided attention to the analysis a creole is kept to wash up the apparatus. Much of the lighter work is undertaken by girls and it is found that on the whole that they are industrious and quick in their work.

SOIL ANALYSIS.

It is very important to be able to determine the tilth of a soil, especially when heavy clays are present, but most methods that have been devised are either too complicated for use in the fields or too inaccurate where small difference of texture have to be measured.

An ingenious method of dealing with this problem has been suggested by Kopeczky who used a slightly tapered tube the lower end of which is sharpened to enable it to cut the soil easily. Owing to the taper of the tube the soil suffers but little distortion as the contact between the soil and the wall of the tube takes place only at the cutting edge.

The technique for determining the ratios between soil, air and water in soil is as follows :—

The tube is pressed into the soil, care being taken to keep it vertical, until hand pressure causes no further movement. A flat piece of board is then placed on the top of the tube and struck smartly with a mallet until the edge of the tube is level with the soil surface. The whole is then cut out *en bloc* with a spade and the surplus soil is sawn off from the bottom with a hack-saw blade to prevent the puddling of the soil as is the case when a knife is used. The tubes are then capped and removed to the laboratory, where they are weighed as soon as possible. This weight consists of a mass of soil and water in a tube (the tubes being previously calibrated for weight and volume.) The bottom cap is now replaced by a gauze bottom and the whole immersed in water to the top of the tube for a period of 24 hours in order thoroughly to saturate the soil. At the expiration of 24 hours the tubes are removed and allowed to drain until the water just fails to run in an unbroken stream. The second weighment will then give the mass of soil completely saturated. The tubes are allowed to drain in a saturated atmosphere for 24 hours and then weighed to determine the moisture holding power of the soil. Finally the soil is dried out completely at 105 degs, C. and weighed again. A small quantity of the dried material is weighed out and ground in a mortar with a little water. After trituration the liquid is transferred to a basin and boiled to remove all entangled air, and when cool the whole is poured into a small density bottle and the true density determined. From weighments Nos. 1, 2, 4, together with the density and the known volume of the tube it is possible to calculate the percentage volume ratios of soil, water and air. This method has been used to determine the difference in tilth on land part of which has been forked and part Rototilled. The results of six parallel samples are given below :—

Forked land.			*Rototilled land.*		
Soil	Water	Air.	Soil	Water	Air.
44.3	25.6	30.1	35.1	18.3	46.6

Same samples after 24 hours saturation and 24 hours draining.

43.1	38.4	18.5	36.7	35.8	27.5

The above figures show well the improved drainage from Rototillage.

Several samples which have been taken on very wet land gave the proportion of air almost nil which was to be expected as the soil was almost perfectly compacted.

A subsoil sample from the back dam of Pln. Chateau Margot which was known to be poor had the following composition.

PERCENTAGES BY VOLUME.

Soil	Water	Air
51.2	47.0	1.8

It will be seen from these figures that the soil was highly compacted and in a bad state of cultivation.

In all cases at least six parallel samples were taken but it would appear advisable in future to take twelve, as the larger number gives a far more trustworthy result.

This method of tilth analysis can be of great value where different methods of cultivation are being attempted or where information is required as to the condition of the land for planting.

Early in the year the late Chairman suggested it, might be advisable to conduct a series of manurial experiments on a sand reef in order to compare the results with those of the Manurial Plots at the Experiment Fields which are on heavy clay. The situation of the sand reef was thought to be in the neighbourhood of field 16 W. on the Sophia Station. Accordingly a small survey was conducted on the whole of Field 16 W. and part of 17 W. The Field consists of 14 beds but it was found that the two beds at either end of the field was not of the same size and could not therefore be brought into concordance with the remainder of the field.

Each bed was divided into 7 plots of 1/30 of an acre and eight cores were taken from each plot. Half the number of cores were taken near the centre of the bed and the remainder towards the outside in order to reduce the sampling error due to curvature of the beds.

The samples were taken from two horizons, the first eight inches being the top soil and the second eight inches the sub-soil ; altogether 168 samples were analysed.

The method of analysis used was the official beaker method, the fractions being graded in Gravel, Coarse sand, Fine Sand, Coarse Silt + Fine Silt + Clay.

In no case was there found more than a fractional percentage of Coarse Sand, the residue after ignition being merely the siliceous remains of plant origin.

The mistake concerning the existence of a sand reef is probably explained as follows. When the sideline and the navigation trenches were being dug, Fine Sand together with Coarse Silt were encountered at about four feet and were thrown up on top of the beds with the rest of the material, thereby giving the soil the appearance of being sandy.

As the soil did not differ materially from that of the present Manurial Plots, it was decided not to carry out the scheme.

Some soil samples were taken about the middle of the year at Pln. Chateau Margot for a detailed chemical examination. Unfortunately there was insufficient apparatus in stock to allow the work to be carried out rapidly, in consequence of which the examination has had to be postponed as the commencement of the grinding season was due.

This work will be continued as soon as possible after the milling is complete.

A. D. ELMSLY LAUCHLAN,
Chemist.

"BOYS' AND GIRLS' CLUBS."

The Editor:
The Journal of the Board of Agriculture.

SIR,

There is being evinced, as the result in a great measure of the improved drainage and irrigation schemes, a quickened interest in Agriculture among our farmers, which cannot but be beneficial to trade and be very heartening to whoever is appointed to the post of Director of Science and Agriculture, rendered vacant by the lamented death of Sir John B. Harrison, C.M.G. If the person so appointed is sympathetically inclined to the needs of the farmers and prepared to assist and encourage their efforts, we can, I think, confidently look forward to witnessing a big forward movement in so far as Agriculture is concerned.

The Colony is generally referred to as an Agricultural one, but truthfully it cannot be so called taking the meaning of agriculture in its broad sense as including live stock. Far too little attention is paid to the stock of the small farmers, and to the improvement of the stock of the Colony in general.

An examination of our list of imports will convince any unbiased party that there are many items appearing thereon, which should be supplied by our farmers, and a surplus left for export. I do not think the importance and value of the agricultural industry outside of sugar is fully realized.

Our imports of the following for the year 1925 speak for themselves:—

Beef Brls. ...	5,953 ...	$ 132,952
Butter lbs. ...	530,945 ...	192,163
Cheese lbs.	199,570 ...	52,606
Cocoa lbs. ...	218,471 ...	32,729
Cornmeal bags ...	2,811 ...	18,648
Ginger lbs. ...	58,328 ...	12,709
Hams or Bacon lbs. ...	173,850 ...	61,942
Lard, cases ...	11,262 ...	54,860

Milk Cond. cases	18,465	154,523
Oil, Cotton Seed glns.	31,167	37,448
Onions lbs.	1,450,683	64,297
Pork brls.	7,154	199,883
Vinegar pkgs.	1,662	3,961

The time I consider is now opportune for the establishment of what are termed " Boys' and Girls' Club " in America and Canada, " Young farmers' Clubs " in England, " Pig Clubs " in Scotland, as I understand so far they have only aspired to one class, as in Barbados there are only " Goat Clubs." I am of course open to correction and welcome it.

The inception of these clubs had their origin in America by the inauguration of " Corn Clubs," and it has been said that to these clubs America owes the expansion of its corn industry. So rapidly did these clubs find favour and increase that it was found necessary to form "Pig Clubs " in order to consume the over production from the " Corn Clubs " and these were followed by the " Poultry Clubs " for the same purpose.

Government quickly recognizing the part these clubs were playing among the youth of both sexes, and the benefit in the cause of agriculture took them under their control by giving the Agricultural Department their supervision.

It was not long before the Canadian government also perceived the value and importance of such clubs, but looking presumably to the fact that youth being the period when impressions are most likely to be receptive decided to work through their Education Department, assisted by the officers of the Agricultural Department.

The clubs in Manitoba—Canada embrace the following :—

Calf raising
Pig do.
Poultry do.
Grain Growing
Home Gardens (vegetables)
Cookery
Sewing
Canning
Noxious Weeds
Dairying
Wood Working and
Essay Writing

In Ontario, the Government, by means of promoting bacon hog clubs, is endeavouring to bring about a uniform brand of bacon in Ontario. Some 150 such clubs were established last year (1925) alone in Ontario, bringing the present total to 257.

Notable progress has also been made in poultry raising in Canada to which the laying contests held in every province in the Dominion have materially contributed.

With the advent of registration for poultry the standard was' raised from 150 to 200 two-ounce eggs as a minimum for qualification, and the bird must also conform closely to certain standard characters laid down for the breed.

In Saskatchewan, Canada, exists a poultry pool with a hen population of more than 9,000,000. Since the initial steps for organization were taken a year ago 9,500 poultry owners have signed full or partial contracts with the pool, binding them in matters of poultry and poultry products, turkeys, ducks and geese, with the exception of breeding requirements. British markets and Eastern Canada will absorb a large proportion of the output.

The establishment of these clubs in the village centres, and on the sugar estates of the colony should go a long way in solving the back to the land problem. Competition will be aroused by the holding of frequent shows as also interest and excitement.

It has been truly said by a writer "No Country can exist without a labouring class, and a nation of shop-keepers, petty traders, and hucksters to the exclusion of the tiller of the soil, would be a phenomenon in political economy."

Hon. A. B. Brown in his very interesting address given at the business session of the British Guiana Congregational Union at Providence Church on Wednesday 19th May, duly reported in the press, has furnished the Government with food for thought, and he did not neglect to point out where they have been negligent as regards their educational policy. It is an address that deserves to be very carefully perused and digested by those having the true welfare of the colony at heart.

I am,

Sir,

Yours etc.

J. A. BARCLAY,

72, Barrack Street,
Kingston,.
22nd June, 1926

* * *

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first six months of 1926.

The corresponding figures for the same period during previous years, and the average for the same period for eight years previous to that are added for convenience of comparison.

Product.	*Average 1916-23.*	*1924.*	*1925.*	*1926.*
Balata, cwts. ...	2,958	4,073	3,330	4,457
Cattle-food (Molascuit) tons	699	434	692	430
Cacao, cwts. ...	11	None	None	None
Cattle, head ...	220	199	357	11
Charcoal, bags ...	23,418	22,087	16,887	16,344
Citrate of Lime, cwts.	100	None	None	None
Coconuts, thousands	1,342	982	603	422
Coconut Oil, gals. ...	12,266	12,192	14,209	12,550
Copra, cwts. ...	1,001	11,798	7,670	28,478
Coffee, cwts. ...	3,196	4,475	3,681	6,445
Essential Oil of Limes gals. ...	92	None	81	153
Firewood, Wallaba, etc., tons	4,151	3,625	3,476	4,470
Gums, lbs. ...	1,717	None	None	866
Hides, No. ...	2,439	5,254	5,342	3,976
Kola-nuts, cwts. ...	2	None	None	None
Lime Juice, gals. ...	3,628	3,226	2,479	2,511
Lumber, ft. ...	88,096	75,644	44,288	116,988
Molasses, gallons ...	30,286	123,388	503,502	592,424
Pigs, No. ...	152	242	516	309
Railway sleepers, No.	6,233	9,000	23,515	5,184
Rice, tons ...	5,318	2,197	3,580	1,725
Ricemeal, tons ...	18	None	None	None
Rubber, cwts. ...	37	3	None	146
Rum, gallons ...	1,485,645	449,865	725,522	480,129
Sheep, head ...	27	17	6	None
Shingles, thousands	1,061	572	1,077	766
Sugar, tons ..	40,338	41,125	41,248	41,498
Timber, cub. ft. ...	64,766	80,533	134,535	136,272

Meteorological Data—April—June 1926.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evapo-ration.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
April ...	·48	2	1	...	...	...	3	7·69	87·7	77·2	82·4	68 9
May ...	12·94	...	9	3	4	1	17	4·83	86·6	76·9	81·7	76·3
June ...	20·82	3	8	3	5	3	22	3·65	85·4	76·3	80·8	81·9
Totals	34·24	5	18	6	9	4	42	16·17				
Means.	...	...	...	...	...	...	...	...	86·6	76·8	81·6	75.7
Berbice Gardens.												
April ...	1·40	3	1	...	1	...	5	...	88·0	75·0	81·5	69·5
May ...	13·15	5	11	2	3	2	23	...	87·3	75·3	81·3	78·9
June ...	15·26	6	14	2	3	1	26	...	87·3	74·8	81·0	79·6
Totals	39·81	14	26	4	7	3	54	...				
Means.	...	...	...	...	...	...	...	...	87·5	75·0	81·3	76·0
Onder-neeming.												
April ...	·44	...	1	...	...	...	1	...	89·0	74·0	81·5	...
May ...	9 36	1	6	5	2	1	15	...	88·0	73·0	80·5	...
June ...	16·42	2	6	4	6	1	19	...	87·0	73·0	80·0	...
Totals	26·22	3	13	9	8	2	35	...				...
Means.	...	...	...	...	...	...	...	...	88·0	73·3	80·7	...
Mora-whanna. N.W.D.												
April ...	·78	3	1	1	..	...	5	...	...	...	...	...
May ...	5.43	1	3	...	1	1	6	...	...	...	...	...
June ...	10·02	3	8	7	3	...	21	...	...	...	...	...
Totals ...	...	...	...	...	...	...	...	...	...	...	..	...

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330
1925	3,317	2,755	1,580	1,819	470	1,663	1,597	13,201

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JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. XIX. OCTOBER, 1926. No. 4.

EDITORIAL NOTES.

We have devoted a large amount of space in this issue to abstracts from the proceedings of the British Guiana Farmers' Conference held in August, in order that farmers throughout the Colony might have the opportunity of perusing the very instructive addresses by the various speakers at the Conference. If we are to use the inspiring speeches at this Conference as a criterion, then we may rest assured that an agricultural awakening is taking place in the Colony.

The Government Fruit, Vegetables and Produce Depôt referred to in our last issue is now an accomplished fact, and the amount of patronage given to it both by the farmer and the consumer has already shown that the necessity for such an agency was a very real and pressing one. We take this occasion to remind our farmers, using the words of Mr. F. A. Mackey, "that it is entirely up to them to make it a success or a failure."

By inviting Mr. S. M. de Freitas to speak on "Cattle Rearing," the Conference seems to have made a very happy choice. One cannot read his address without realizing that, in so far as the breeding of cattle is concerned, whether it be from the point of view of producing beef or for the purpose of increasing our milk supply, this Colony is very backward. This we feel is due as much to indifference and lack of knowledge, as it is to the absence of a spirit of co-operation on the part of cattle owners. We trust that the advice given will be taken to heart by those concerned, and that in the near future, the quality and quantity of the beef produced in this Colony will be greatly improved.

The question of Pine-apple Cultivation was dealt with by the Hon. Hector Josephs in a very practical manner. We endorse his statement as to the suitability of the soil conditions in the highlands of the North West District for growing this crop. We are also of the opinion that the cultivation of pine-apples on a large scale in this Colony is a matter which requires very careful consideration.

In connection with the article by Mr. T. A. Archer on "The Cultivation of Tobacco," we would like to point out that it is not the suitability of the various kinds of soils which has to be considered in this Colony, but the favourableness or otherwise of the climate with regard to curing the product. It was this factor that caused previous growers to abandon their somewhat extensive experiments with this crop. It is creditable that Mr. Archer has actually grown and "cured" a tobacco which is considered by smokers to be quite good. All tobacco grown here would have to be cultivated as a garden crop, and not extensively, as this would require a large capital and a numerous labour force which, at present, is not available. Here and there in certain parts of the Rupununi Savannahs tobacco is grown, and small areas of land, (*e.g.* the sites of abandoned factories, etc.,) are also found suitable. These small areas can be profitably exploited, but as an Industry, we are afraid it has nothing to recommend it so far as the coastlands are concerned.

B. G. FARMERS' CONFERENCE.

TENTH ANNUAL SESSION.

The 10th Annual Session of the B. G. Farmers' Conference was held at the Wesleyan School Hall, Mahaicony, on the 24th August, 1926. The Session was opened by Hon. J. Hampden King, acting Colonial Secretary.

On the platform were Mr. H. A. Britton, President of the Conference, Hon. J. J. DaSilva, Revs. W. E. Giddings, W. A. Deane; Messrs. Edwin Bacchus, J.P., A. K. Amin, B.A., L.L.B., C. R. Williams, R. McArthur (President of the Mahaicony Farming Association), Dr. S. N. Bruce (acting Government Veterinary Surgeon), E. M. Morgan and C. C. Dowding (Agricultural Instructors) and the following delegates:—Messrs. D. D. Haynes, R. McArthur, E H. Underwood, A. Rohoman, J. E. Palmer (Bagotville), Rev. W. A. Deane and Mr. D. P. C. Lambert.

PRESIDENTIAL ADDRESS.

After the usual opening exercises, the President delivered the following address :—

Officers, accredited Delegates of Associations and Friends :—

Once again it is my privilege to address you as the Chairman and pleasant as that duty was in the past it is the greater to-day not only because the major difficulty is being tackled, but more so because drainage, a fundamental to successful farming will in the not distant future be an accomplished fact. Moreover, at no previous time in the history of the colony has the outlook for improving his position been so roseate to the small farmer as it is now.

THE LATE DIRECTOR.

Following upon intermittent attacks and a painfully severe illness, Professor Sir John Burchmore Harrison, C.M.G., M.A., F.I.C., F.G.S., etc., for many years the talented and respected head of the Department of Science and Agriculture died in the Lady Thompson Ward, Public Hospital, Georgetown, on 8th February last. The outstanding characteristic of the late head of the Colony's Agricultural Department was his strict honesty of purpose and unselfish devotion to his multifarious duties.

OUR NEW DIRECTOR.

During July the Governor Sir Cecil Hunter Rodwell was intimated by the Secretary of State for the Colonies that Mr. W. Nowell of Trinidad, was appointed as successor to the late Sir John Harrison as Director of Science and Agriculture. Mr. Nowell is expected to assume the duties of his office on 1st November next and he is assured of the loyal support and hearty co-operation of this Conference, the various County and District Associations and small farmers scattered over the length and breadth of the colony. It is well that opportunity be taken to warn one and all not to expect too much of Mr. Nowell who will have cast upon him as he enters upon his duties the remodelling of the Department to bring it in line with those of other progressive colonies.

THAT OLD FRIEND.

Mr. R. Ward, O.B.E., went on leave of absence early in the year with permission to retire at the expiration of his leave. This Conference wishes for its old, true and trusted friend many years of life in the enjoyment of his well earned pension. On it becoming known that Mr. Ward will retire, the Executive Committee acting on behalf of Conference, passed, and the Secretary forwarded to Government a resolution regarding the class and type of person to be appointed as successor of Mr. Ward. For that resolution I plead with the Governor for sympathetic consideration. Moreover it is a reproach to the Government to have any trained scientific officer engaged in purely clerical duties.

GOVERNMENT PRODUCE AGENCY.

United agitation for years by the Village Chairmen's and this Conference failed where a memorandum by Mr. G. D. Owen, Assistant Colonial Secretary, succeeded in getting Government to move and the Combined Court to vote a sum considered necessary for the establishment of a Produce Agency under Government supervision. A Committee has been set up to work that latest innovation, but the opinion has been expressed that not only is the Agency being launched at an inopportune time but that the Committee charged with its working, is incomplete in that it lacks a representative of the Chamber of Commerce and a representative of the small farmers for whom the Agency ostensibly intended to benefit. The task which faces the Committee is by no means enviable because of a reported determination on the part of the middle-men in the Stabroek Market and elsewhere to combine with a view to bringing about the failure of the Government Produce Agency.

ACTION AND NOT TALK.

The very sane and practical address by Mr. Mackey already referred to has been productive of some good despite the continued marking time policy on the part of Government. Several persons in various districts planted patches of ground nut, which in some instances got burnt by fire, and in others scorched during the recent protracted drought. In one instance for the first time, as far as ascertainable, an acre or thereabout was put under Black Eye Pease cultivation which when the June rains descended in torrents was flooded out. Moreover, never before has there been such a demand on the Botanic Gardens for Economic and other Permanent Plants than at the present moment. This is encouraging in so far as the future is concerned, notwithstanding that presently there is no sustained supply of fruits for local demand nor can any reliable information be procured, regarding the area under cultivation of the various fruits. Time was when Jamaica the premier fruit growing colony of the West Indies was in no better position than we presently find ourselves; but to-day that trade is so fully organized as to render procurable the acreage under cultivation with but little or no trouble. It is therefore not too much to expect that before the end of this quinquennial period in the matter of information regarding the area under cultivation of fruits and other crops this colony will be in the same position as Jamaica.

FARMERS CHALLENGED.

By way of its earnest desire to co-operate with and assist the small farmers in the disposal of their fruits, and to encourage people to eat more fruit, colony's premier firm, Messrs. Booker Bros., McConnell & Co., Ltd., have made suitable arrangements at their Amalgamated Groceries Department to handle Grape Fruits, Pine Apples, Oranges, Shaddocks, Pears and other fruits, provided however, the fruits are of a certain standard and the producers of those fruits do not themselves or by their agents sell cheaper to others than to them. This magnanimous offer should not only be an incentive to the small farmers to produce the best but a challenge to them all to take their fruits to Mr. W. I. Rugman, the approachable manager of the Amalgamated Groceries from whom they get a straight deal and prompt payment, what time fruits are taken.

It but now remains for me in the most emphatic manner and in language that admits of no equivocation to enjoin all farmers to take their Grape Fruits, Oranges, Pine Apples and Shaddocks, also Pea-nuts and Black Eye Pease to Bookers Amalgamated Groceries since it was left to Mr. F. A. Mackey, a director of Messrs. Booker Bros., McConnell & Co., Ltd., to be the first person in a practical manner to bring about closer relationship between a commercial house and the small farmer in the articles named and thus is laid the foundation upon which can be built an Export Fruit Trade.

EXPERMENTAL STATIONS.

Subsequent to the adoption by the Board of Agriculture of the scheme for the establishment of three 100-acre Experimental Stations, a joint meeting of representatives from the Chamber of Commerce, the British Guiana Sugar Planters' Association and the British Guiana Farmers' Conference was held in the Exchange Rooms, Museum Buildings, on Thursday, 5th November, 1925, to discuss at the request of our Conference "The possibility of developing a Local or Export Fruit Trade as well as to investigate any other grounds whereby the small farmer may be encouraged to make some contribution to the general industrious well-being of the colony." At the meeting there were present Messrs. C. Farrar, President of the Chamber of Commerce, who presided, F. A. Mackey, M. B. G. Austin and E. M. Walcott, F.R., representing the Chamber of Commerce and the B. G. Sugar Planters' Association, and Messrs. R. Reuben Baird, Edward Isaacs and myself, representing Conference. The report of the joint committee which was highly favourable in point of fact, endorsed in principle the scheme approved of by the Board of Agriculture and with all the Executive Government appears to be still at its game of procrastination rather than rushing to give opportunity to the small farmer to make hay while the sun shineth. Though as a Conference we have abstained from dabbling in politics it would be nothing short of a suicidal policy should steps not be taken through voters—members of affiliated Associations, to exact a promise from aspirants for political honours at the forthcoming General Elections that should Government not insist in the next annual estimate the sum estimated as being required for establishment of the first hundred acres Expermental Station that a resolution recommending the insertion of the amount be tabled and to be unanimously supported by the Electives.

POULTRY.

It is gratifying to record a noticeable improvement of poultry in an important rural district, and I look forward to an infusion in other centres especially as at the present moment with Mr. W. Francis, F.I.C., acting Director of Science and Agriculture, as Chairman, a Committee of the Board of Agriculture is engaged in considering the question of the establishment of a Government Stock Farm.

ANNA REGINA VENTURE.

This scheme, launched by the Thomson Government, is still in its embryo stage, and everything should be done by those responsible to inspire the people's confidence in the venture which should be given a fair trial.

Owing to the market, the farmers there and elsewhere in the Colony have experienced very trying times, but they are nevertheless not down-hearted, but instead are hopeful for the future.

GENERAL.

From time to time criticisms are being levelled at our farmers for not being possessed of any initiative nor self-reliance, preferring, however, to be looking to and to be dependent on Government. Well, may it be asked of those who criticise the farmers if at any time they have paused and instituted a comparison between farmers here and elsewhere. It is safe to assert that nowhere in the world do farmers labour under the difficulties as our farmers are compelled to fight against. Had the sugar cane not been less susceptible to perish from floods, and despite the subsidy the industry get from the Government, it would have been extinct years ago. The wonder is that without any subvention the local farmers have stood so firm and loyally by a losing game, because of no fault on their part, through recurrent floods and drought.

An enemy more vicious than flood or drought is the Congo Bush now faces the farmers owing to the rapidity with which it is spreading. Its eradication is without doubt beyond the resources of the farmers, hence I invite Government attention to the matter.

Similarly as a grant is given to the Royal Agricultural and Commercial Society, so too ought a grant of say $240 be given this Conference through the Department of Science and Agriculture. The Conference is engaged in doing educative and propaganda work among the small farmers who are slowly but steadily appreciating the work by Conference.

CONCLUSION.

It is hardly neccessary for me, ere I resume my seat, to enjoin delegates to give to the various items on the Agenda the consideration which each on merit deserves at your hands as representatives of the small farmers of British Guiana.

The Chairman, The Hon. J. Hampden King (Acting Colonial Secretary), was introduced by Mr. R. McArthur, Vice-President of the Mahaicony Farmers' Association.

Mr. Hampden King in declaring the meeting open said: "Mr. President, ladies and gentlemen, when I was asked to come here to-day by Mr. Aaron Britton and Mr. Haynes, the first thought which came into my mind was that a meeting such as this will be more properly addressed by one having practical connection and knowledge of agriculture. I regret to say I must hold myself as being very much wanting in both these qualifications but no one who has the interest of the Colony at heart can ignore the fact that agriculture is of vital importance to the community as a whole (applause). It therefore gives me very much pleasure to be here to-day at the 10th annual Conference of the British Guiana Associated District Agricultural Societies, and I think it must be a matter of congratulation to Mahaicony that Mahaicony was selected as the scene of this tenth conference. (Applause). I have on looking through the newspapers noticed that when Mr. Mackey addressed the ninth Conference he pointed out very clearly that as an agricultural community we fell very short of the mark, and not only did we fail to produce from the fields what we should be able to export, but we actually fell short in the sense that we do not produce even enough of the many things which we can easily produce for our own consumption, and we have to send our money away to the neighbouring islands instead of obtaining them there. I am afraid that one must recognise that that condition prevails more or less to-day but I think that there is ground for believing that there is an awakening. There are many things which I think point in that direction. For instance: take the matter of drainage. There is no doubt about it that for years and years agriculturalists have had to struggle against very adverse circumstances in connection with drainage, but, gentlemen, that position has been tackled, and to a certain extent and in certain districts has been vastly improved. That is a matter for congratulation. Then there is the question of irrigation which in some districts is still a very pressing one indeed. I believe that there has been a little improvement in some districts, but in others there still remains much to be done in this direction. Following on action taken in the Combined Court, a depôt for the handling of vegetables has lately been established. This depôt is at present being conducted by a committee of practical men and it seems to me that although as time goes on we may find certain directions in which improvement may be effected, there is no reason why this institution should not prove of great practical benefit as it has proved itself in neighbouring Colonies. (applause). There is also one other matter which sprang out of action taken in the Combined Court and that is the institution of an Agricultural Loan Bank. That would be a very important thing for agriculture generally when it is got going. It is an indication that all concerned are paying attention to this most important matter of agriculture. This brings me to a point which I think may well be emphasized and that is

THE NEED FOR CO-OPERATION.

When a matter of importance comes up, the obvious and practical course is for all of us to get together and examine the situation in a spirit of determination, sift it thoroughly and come to a definite conclusion on the merits of the "***pros***" and "***cons***." Unfortunately, I am sorry I have to say it but I do say it, we have got into the vicious habit of almost taking an entirely different course. We pay little or no attention to the merits or demerits but at once divide ourselves into two camps, each more concerned in downing the fellows in the other camp than with the merits of the question involved. That is not a pleasant thing to say but it is there. I am, however, not saying that attitude of mind is confined to any particular section of the Colony, but it has been forced upon one more and more every day that it seems to be universal. I think it is as vicious a course as it is universal. I might say that the Delegation from British Guiana to the West Indian Conference when in London had the good fortune to listen to an admittedly considered authority on Agricultural Organization. I refer to Mr. F. L. McDougall, C.M.G., Australian Representative on the Imperial Economic Committee. Until we had the advantage of hearing Mr. McDougall I do not think one of us had any real understanding as to what an agricultural organisation really meant. We had some hazy idea, but no sound idea as to the many things which go to make up such an organization. I certainly did not. One of the things very clearly put before us was the need for co-operation. From the very beginning—from the time you put the plant into the earth up to the time you market the produce. In connection with the marketing of the produce one of the prime necessities was that nothing should be put on the market which was not what it was intended to be. In other words only the best must be put on the market and that was managed in connection with the Australian business by co-operation among the people themselves. It was their own organization, and they took very good care that none of the members of these different societies ever sent away what was not the prime produce with the result that when they get a market they hold it. I think it is universally acknowledged, that if the producers passed on to the markets which they were lucky enough to get hold of stuff, which does not come up to the standard, the result was they lose those markets. The buyer is not going to worry his head to sort out stuffs, he must be able to depend on his getting what he is told he will get. Bearing somewhat on the question of not working together, we delegates found on two or three occasions in London when discussing matters—our wants and things of that sort—we were met with the remark, "you say you want so and so, well it does not seem to us you really do know what you want. As far as we make out you seem to occupy your time in quarrelling with each other." That is actually thrown in our teeth, and it all points to the fact that we have been following the wrong course and we ought to do all we can to revise our methods. There is one matter, I think, on which we can congratulate ourselves and that is the new Director of Science and Agriculture, whom we hope to see here shortly, is a gentleman who is primarily an agricultural expert, and I think that is something that we ought to be glad for and something which ought to lead to the improvement of things in the agricultural line which I am perfectly sure we all wish for (applause). If the advancement we all wish for is to take place we must pull together and not apart as we have been doing in the past (applause). It gives me very great pleasure to be here to-day and to see this big representative gathering of farmers and those interested in the land, and I hope that this Conference, as it is the tenth, will not be the last, but that your Association will continue to grow and flourish, and that you will have many more conferences and that all good luck and good fortune will attend you. (Applause), I declare this Conference opened, and in doing that it would have given me the greatest pleasure to remain for the two other sessions, but unfortunately, duty requiries that I should return to headquarters within a very short time. (Cheers).

Replying, the President, Mr. Aaron Britton assured the Colonial Secretary that his presence there that morning was a guarantee that this their 10th annual conference would certainly not be the last and would also be an incentive for still greater determination on the part of the farmers of the Colony to achieve that which he (the Colonial Secretary) had laboured, and laboured successfully that morning, the idea of co-operation. He thanked the Colonial Secretary on Conference's behalf for having declared the Conference open and expressed their appreciation of the straight, plain talk which he had given them.

The B. G. Farmers' Conference concluded its deliberations with a public meeting in the evening in the Mahaicony Scots school-room. Mr. F. A. Mackey presided, and supporting him on the platform were His Worship the Mayor of Georgetown. Hon. R. E. Brassington, Hons. Hector Josephs, K.C., B.A., LL.M., (Attorney General). and F. Dias, Messrs. S. M. de Freitas, B.A., B.C.L., E. F. Fredericks, LL.B., E. M. Walcott, F.R., H. A. Britton (President), H. A. Thompson, and H. F. Pollard (Vice-Presidents), J. R. W. Straughn, (Treasurer), R. P. Carryl (Minute Secretary), D. D. Haynes and R. McArthur (President and Vice-Presidents, respectively of the Mahaicony Farmers' Association), D. W. Fingal, J.Z. Peters and H. L. Palmer, also Mesdames Walcott and D. Fullerton. The hall was crowded with a large and respresentative gathering, among whom were Mr. and Mrs. Thos. Barlow, Mr. and Mrs. Holder, Dr. R. S. Miller, Messrs. Fullerton, S. E. Gomes, C. A. Dowding, E. M. Morgan, A. Hughes, J. E. Henry, and a bevy of ladies.

Mr. R. P. Carryl, Asst. Secretary of the Conference, next announced the results of the election of officers of the Conference which had taken place that afternoon and which resulted in the re-election of all the officers with the exception of Mr. Stanley E. Thierens, who was displaced by Mr. R. P. Carryl for the post of Minute Secretary, and the addition of the Rev. W. A. Deane to the Committee of Management.

INTRODUCTION OF CHAIRMAN.

Introducing the Chairman of the evening, Mr. Aaron Britton, President of the Conference said: "Ladies and gentlemen, mine is a very pleasant duty to introduce to you as Chairman of this meeting to-night no less a person than Mr. F. A. Mackey, a son of the soil (applause). Mr. Mackey may in the course of his remarks refer to the fact that he is not a public man, but so far as this Conference is concerned, I think I am safe in saying that no public man has to his credit as great an accomplishment within a period of one year as Mr. Mackey has achieved as the result of his speech to us last year. Peanuts, black-eye pease, coffee and other products were not considered or cultivated on a commercial basis. Mr. Mackey came to us last year by our invitation, and in the course of a very plain talk with us, not with a spirit of carping criticism, but with a desire to assist us, intimated clearly and with earnestness, channels in which he considered improvements were possible to be made. Conference accepted his criticism, and to-night Mr. Mackey has the pleasure in knowing that away up on the Corentyne nuts have been planted, also on the West Bank and other parts. On the West Bank plenty of black-eye pease have also been planted, and I have been told the fashion nowadays in most homes on the West Bank is to have black-eye pease soup as a meal in the afternoons. I think therefore that Mr. Mackey has done good service. It is not surprising, because Mr. Mackey, as a son of the soil, coming in succession to his father may, perhaps some day attain to his father's eminence in this colony, who not only in the legislature but on the Executive Council has done in a quiet and unobtrusive manner good work. Although not born in this colony, his father was greatly attached to the colony, and after his death his body was brought from accross the seas and entombed in this colony. Mr. Mackey as a creole is very anxious over the welfare of the people, because as he told me on occasions more than once that with the people prospering everything would go well.

We have a very lengthy programme, and therefore I would not trespass on your time, because those of you who have programmes would see we have giant intellects to-night. Conference is exceedingly gratified at the attendance of these gentlemen on the platform who have done so at some personal inconvenience. We are glad you are here, and we are particularly glad that we have Mr. Mackey with us. Mr. Mackey had almost said to me I would never come out again, but after I prevailed on him he came out last year and he did his duty so efficiently that the Committee was insistent that we leave no stone unturned to get him once more. In fact, one man suggested that he should be a permanent fixture so far as

Conference is concerned. It is better to have a friend than to look for one. Mr. Mackey has demonstrated in a practical manner his sympathy with the farmers, and I have great pleasure in asking him to take the Chair and to preside over this meeting.

MR. MACKEY'S SPEECH.

The Chairman, addressing the meeting, said:—"Ladies and gentlemen,—I thank you for the privilege which you have accorded me by asking me to preside at this public meeting this evening, which I see is held under the auspices of the British Guiana Asssociated Districts Agricultural Societies, and for the opportunity that you have given me of saying a few words about the agricultural possibilities of this colony. You may have observed that I use the words agricultural possiblities. I do not use the words agricultural industry, because it is an indisputable fact that apart from the established industries of sugar, rice, etc., we have no orginised agricultural industry at present. It is not pleasant duty for the Press, it is not pleasant for me or any of us, to find fault with the farmers of this colony. It has been said, and I think it has been rightly said, that year in and year out we have conferences and meetings, but so far we have not really shown any material advancement in our attempts at agriculture. One year we are told of disastrous floods, another year we are reminded of the drought, but the Government, as you know, have now given us drainage. I believe irrigation schemes are on foot. You are also getting Artesian wells, and if you do not make any strides in the future it will be interesting to hear what excuses will be offered. I feel sure that there will be no need to offer any excuses because there certainly seems to be a very decided and keener interest taken by the farmers and a determined effort on their part to improve their lot in life not only for their own good but for the good of the colony generally. During the last year there has been a joint conference of the Chamber of Commerce, the Planters' Association and the Farmers' Conference in Georgetown. This conference to my mind certainly seems to show that there is a better feeling of co-operation existing between all classes of the agricultural community including the sympathy and co-operation of the sugar estate proprietors. The report of the meeting, I have no doubt, has been well studied and digested by all of us who take an interest in the agricultural possibilities of this colony. There are, as you have been told on many occasions, great possibilities for this magnificent colony of ours, and perhaps I can do no better than give you certain information which I have read from the report of the Imperial Economic Committee which sat last year to discuss the question of marketing and preparing for market foodstuffs produced overseas. In this report I have read that the development of banana cultivation within the Empire comprised a number of separate and independent problems. The supply to the home market of bananas grown within the Empire is a problem in itself and must be treated as a single undertaking from the point of production to that of retail sale, otherwise the committee tells us any scheme will break down. There must be, and this is most important, as far as this colony is concerned, an adequate supply to guarantee a shipping service and that service must remain independent of any exsisting monopoly. In other words there must be a gaurantee of supply of independent shipping and of a market. The recommendations of the conference held last year, to which I have referred, have been strongly endorsed and borne out by the committee, and special reference has been made in their report to British Guiana.

BANANA CULTIVATION.

Amongst those references I read that the committee are perfectly satisfied that we have ample accessible lands in British Guiana for the cultivation of banana, but the governing factor is the Panama disease, and certain recommendations have been made with regard to the variety which should be cultivated. They strongly endorse the recommendation of our local conference to establish experimental ten-acre plots in various districts in the colony, but this question has been deferred until the arrival of the newly-appointed Director of Science and Agriculture from

Trinidad. What is a very important recommendation in this report, and I feel it is a recommendation that will probably appeal to you, is one from the committee that for such experiments financial assistance might be given up to $2,000 a year. If this recommendation is carried out by the Imperial Government we only hope that it will be well expended in a well-thought-out system of cultivation, and that in two or three years we can say that the money was well spent. I understand that the Combined Court has from time to time voted various sums of money for experimental purposes. I may be wrong, but I think it is in regard to cotton ; so far nothing has been done. I speak, however, subject to correction.

THE GRAPE FRUIT.

Another fruit that could well be cultivated here is grape fruit. This fruit is rapidly gaining popularity in the United Kingdom, and if we can produce it of good quality and in appreciable quantities, I am quite certain that it will meet with a very ready market in England. Oranges are also very largely imported into the United Kingdom, and you would be interested to hear that out of 375,980 tons imported into the United Kingdom in 1924, 84.6 per cent. came from foreign countries, and from British ports only 15.4 per cent. Out of this 15.4 per cent. the West Indies contributed the magnificent total of 8 per cent. There is also a good, market indeed for ground nuts in the United Kingdom especially for pea-nuts, but the buyers on that side would naturally like to see a sample. I have not got the slightest doubt that you will be able to show samples, for this Colony in nuts as well as everything else excels in samples. What we want are samples of what can be produced. With regard to the cultivation of pine-apples, I think this subject can be left in the very capable hands of Mr. Hector Josephs, the Attorney General, who probably knows more about pine-apples than anyone in this part of the world. I have talked quite long enough on the export possibilities, and I am sure that you will agree with me that we should make a start to cultivate fruits which find a very easy market.

Dutch Advice.

You have been told, however, by a gentleman from Dutch Guiana who came over a short while ago that you should not cultivate fruits, that you should confine yourself entirely to ground provisions and vegetable. If I were a Dutchman and not a creole of the Colony, a son of the soil or as otherwise called a " mudhead, " I would no doubt give you that same excellent advice myself because there is no doubt that Dutch Guiana finds a very easy sale for her fruits in this Colony. A short while ago I was offered a shipment of 250 crates of oranges for retail, but this offer I declined for various reasons. The first reason is that I promised Mr. Aaron Britton, your president, that such fruits as we require for our own retail convenience I would prefer naturally to purchase from the farmers of British Guiana. There is another reason as well—I, like all of you, and I pointed it out to Mr. Brassington as well, have seen fruits from other countries for sale in various stores in Water Street. To establish an industry—and we have no organised fruit industry—we have to start slowly. We must compare the establishment of an industry with an infant. An infant, we all know has to crawl before it can walk; and it has to walk before it can run ; and it has to run before it can jump, therefore when we do make a start in establishing a fruit industry we must go about it very carefully and very slowly. First of all, there must be an organised system controlled by efficient and capable men who have made agriculture their life study.

Trees must be regularly planted from selected seeds supplied by the Department of Science and Agriculture. They must be cultivated and pruned and not as they are at present, simply neglected and left to take care of themselves. The tendency to-day seems to be to pick fruit from the tree before it is ripe. I really do not know what the idea of it is, except perhaps that certain farmers realise that if they did not pick the fruit themselves someone else might take it for them. There must be hard work six days of the week instead of as I think has been done until quite recently, only two or three days and the balance of time you spend either sitting down in your houses or abusing one another. If we are successful in establishing a fruit industry in this Colony I think it would go a very long way to settle many of our difficulties, for if we have a fruit industry it would encourage settlers to come down here and those who are here already will be contented and happy.

I would just like to refer to the Government agency and depot in Georgetown. This agency, as you see by the papers, will be opened on September 1st, and will receive fruit and vegetable from the farmers of all the districts in the country. Some time ago you asked for an agency and depôt of this sort and now that you have got what you have wanted it is entirely up to you to make it a success or a failure. I am perfectly certain that you will do your best to make it a success (Cheers).

CATTLE REARING.

Mr. Stanley M. de Freitas then addressed the meeting on "Cattle Rearing" as follows:—

Some time ago I received an invitation from your President to say a few words to you on the improvement of the live stock industry of this colony. It gave me twofold pleasure in accepting the invitation, first, because I was able to anticipate the happiness of addressing so important a gathering of my fellow countrymen for the first time on a subject which I know interests you as much as I know it interests me, and because it transports me in thought back to a part of the world where I spent two very happpy years of my life and which held great charms for me. I refer to the Union of South Africa and especially the province of Natal where I was associated with men of your own mentality. My position in addressing you on this subject appears to be ironical. Gentlemen, I am a lawyer and a lawyer is always looking for precedents, and I have been trying to find a precedent where a lawyer has been invited to speak on a subject so foreign to his own profession. Happily I am able to find that precedent on our programme of this evening's entertainment in which I see that the learned Attorney General is going to address you on pineapples (Applause.) I find myself in another position of irony and that as the chairman told you in his very admirable address, that you would be far better off if you ate more fruit and less beef, and I am here to speak to you on how to produce more beef. (Applause).

IMPROVING COLONY'S LIVE STOCK.

The question of improving live stock in this colony has to be looked at from two separate and distinct aspects. One aspect is the improvement of live stock chiefly with a view to beef production and the other with a view to milk production. I propose to-night only to deal with the first aspect and that is improvement with a view to beef production. In order to produce beef and to produce milk, two separate and distinct methods of treatment have to be adopted. The mere fact that one has been in the position of observing the products of one country as compared with similar products in another country magnifies the efficiencies or deficiencies of the one to the detriment of the other. When I arrived in this colony about 22 months ago as I had taken a great interest in the live stock of South Africa, having been closely associated with stock-breeding for about two years in that part of the world, as I drove along the East Coast my interest was aroused in the class of stock one sees roaming about the pastures. I am sorry I have to admit that the animals of any merit whatever are very isolated indeed. In order to produce live stock of any merit to the colony there is one object to be kept in view and that is infusion of new blood. The agricultural department has got a few pure bred bulls. I do not say that they are outstanding animals and altogether suited for the condition of this colony—but I understand that stock-raisers do not avail themselves of the services of these animals because they feel that the service fee of sixty cents is too oppressive.

I am not for or against the Department because I do not know your side of the case but it would appear to me off-hand that when one considered that these animals cost Government something in the vicinity of $400 or $500 to import and maintain, the fee of 60 cents is not prohibitive.

Pure Bred Bull of Class Wanted.

The first thing to be considered is introducing into the colony a pure bred bull of one of the recognised beef breeds. You have a few Government bulls at your disposal already and you must avail yourselves more of their services. You have a good foundation already on which to make a start and that foundation is the native cows of the colony because they are regular breeders and good mothers. If farmers insisted on having nothing but the best bull available for service they would then see the result almost immediately. Your first calves would be half-bred. But the selection of the right kind and type of bull is a matter of great importance. There are several desirable breeds that can thrive well under local conditions—chief of these being the Aberdeen Angus and the Herefords. I am more inclined to the Aberdeen Angus because it is a short-coated animal, it is polled or hornless and of very early maturity all of which are very desirable characteristics for a colony such as this. It is also a Scotch breed of animal and as you know, gentlemen, for generations past, Scotchmen have earned a very enviable reputation for being thrifty, economical and good colonists. Their live stock seem to have acquired similar characteristics. It is absolutely necessary that if these bulls are to be imported from the United States they must not be imported from one of the tick infested districts of that country, otherwise they are sure to get Red Water which is known in the United States as Texas fever. Failure to take this precaution in the past has led to very distressing results. The result aimed at is that instead of producing an animal that matures in six or seven years you would have an animal maturing and producing excellent beef in about three years or less. It is not only the early maturity but the fact that you are producing more palatable beef which you would be able to market at a better advantage. I know there is no real shortage of cattle in the colony, but a shortage of good cattle. If you had animals that would mature in three years, instead of your having to chase after the butchers to sell them, the butchers would be chasing after you to buy them. To give you an example of the results of introducing pure bred bulls to a native herd, in South Africa an animal that won the Fat Stock Championship two years ago was 22½ months old and weighed 1,850 lbs, and to show you what great interest is being taken in other countries of the world to-day in the production of prime beef you will be interested to hear that the steer which won the International Grand Championship in America last year was bought by Hotel Sherman of Chicago for the record price of $7 per pound. For the improvement of live stock, aim chiefly at early maturity, then a system of grading up is to be followed eventually by selective breeding, and you can only get that by introducing new blood into your native cows and so counteracting the degenerate effects of in-breeding. Every stock-raiser should be competent also to ensure that not only the females of his herd breed regularly, but also that the calves of each year are superior to the calves of the previous year, for your profits depend on the number of calves you get each year and that is largely a matter of management. He must be competent to prevent, and if necessary to cure, the ordinary stock diseases. You are blessed in this colony so far as stock diseases are concerned, in fact you might say you are relatively free from stock diseases. The only diseases with which cattle here are affected to any extent are anthrax and tuberculosis, but if I were to mention only a few of the stock diseases that assail the farmers of the Union of South Africa, for Example, Anthrax, Tuberculosis, Red Water, Gall Sickness, Quarter Evil and Rinder Pest, you will readily see that they almost have the plagues of Egypt to contend with.

PERSEVERANCE AND KEEN OBSERVATION NEEDED.

In order to illustrate to you how individual perseverance coupled with intelligent observation can achieve results which are almost of national importance, it was found that certain very large areas in South Africa though at first glance possessing plenty of natural pasturage, were incapable of maintaining live stock suited for any commercial purpose. The keen farmers in those districts observed that the few cattle that lived there were continually chewing the sun-bleached bones of animals that had perished from time to time on the veldt. This habit was looked into and reported to the Veterinary Department concerned,—which then began to make careful investigations as to the cause for this unnatural craving. A series of elaborate experiments were then conducted by the Government Department concerned, and it was discovered that this unnatural craving among the cattle of old or decaying bones was due to a complete lack of phosphorus in the soil and consequently in the grasses for those districts. It was also discovered that this phosphorus deficiency could be counteracted by a daily ration of two to three ounces of sterilized bone meal. As the result of this discovery that vast extensive but profitless district of the Union became an economical factor in live-stock wealth of the Union. The same to a certain extent applies to conditions here.

Pasturage is a matter of great importance. All the grasses and other vegetations on your estates are very deficient in one of the most essential ingredient in the nourishment of live-stock and that is phosphorus. The soil of British Guiana generally, is very deficient in this substance and I feel that the technical officers in the Department of Agriculture will bear me out on that point. You therefore cannot produce an animal of the type of those produced in Barbados, an island well supplied with lime and phosphorus, unless you counteract this phosphorus deficiency. This substance is a determining factor on the bone formation of animals and tend to enhance their growth and the ultimate size to which they will attain. Animal husbandry cannot be divorced from agriculture, they go together and are essentially enterprises of a co-operative nature. That being so, those desirable results which you should aim at either in animal husbandry or agriculture cannot be achieved without co-operation, and here I feel I must say just a few words on this subject.

Since my return to the colony I blush to have to admit that I have not been able to detect a spirit of co-operation in any sphere of human activity locally. To the reverse, gentlemen, I have observed that there prevails a general atmosphere of distrust and suspicion as between man and man. Often one man is afraid to let his neighbour know the result of his researches perhaps for fear that his neighbour will eventually become wiser than he. The position, gentlemen, is all the more disturbing as one realises that this unwholesome atmosphere is not confined merely to the little minds of little men, but appears to be animating the spirit of men who occupy positions of considerable prominence and importance in our local life and men who ought to set a more elevating example that is worthy of following by you and me who are ready to learn. Unless you are willing to pull together and exchange your views in a friendly spirit there is very little chance of success. When you have started on the road to progress and have gone half-way you will be in a position not merely to ask for Government's assistance, but to demand it and here, gentlemen, I must ask you a question which I should like you to think about in your spare moments and answer yourselves.

That question is, have you really and seriously started on your part of the journey along the road to progress? And remember the race along that road is not a flat race; it is an obstacle race, but all the obstacles are surmountable, some with a greater degree of effort than others, and with such an intelligent class of agricultural labourer as this colony possesses and with soil sufficiently fertile to produce all the things that go to make a healthy, happy and progressive people, it becomes your duty therefore to wrest from the soil those things. (Cheers).

ATTORNEY GENERAL'S SPEECH.

Hon. Hector Josephs addressing the meeting on "The Value of Pine Apple and its Cultivation," said: Mr. President, ladies and gentlemen, my learned friend Mr. de Freitas apologised for being a lawyer, I do not apologise for being a practical agriculturist in spite of the presence of Mr. Walcott, Mr. Brassington, and others I see about me. One of the reasons for it is, I come from an island where life is very hard and we live entirely by the soil. We have not been blessed with gold, or diamonds, or minerals which may or may not be a blessing. It may be a blessing to individuals but may prevent the development of that co-operative spirit of which Mr. De Freitas has so well spoken. The presence of attractions like those may tend to disintegrate the cohesion of the whole and the individuals may go off at a tangent. I do not say that occurs in this colony but that is the result which is not at all unlikely to ensue. In my island home we have got to till the soil. We grow stuffs for export and we grow articles to feed ourselves. One of the good things the War did for us was to intensify our cultivation and particularly with respect to articles for local food consumption, with the result that our importation of foodstuff considerably decreased. I have never grown a cabbage that weighed less than eight pounds. I tried to, but never did it. I was very disappointed if any of my tomatoes weighed less than a pound. I grew Seville oranges from which we made marmalade; grape fruit, sweet oranges, bananas and a variety of other things. We live largely by bananas in Jamaica. During the first six months of this year we exported 9,000,000 bunches of bananas. I suppose that by the end of the year we shall have quite nearly 20,000,000 bunches exported. All of it does not go to England or the percentage of the Economic Committee's Report (referred to by the Chairman) would be different.

With regard to pine-apples I am glad to see there are some good ones grown here. It is a very interesting branch of agriculture to me. My father took it up as a hobby and devoted a great deal of attention to it and experimented a good deal with it and as a result he got very fine results indeed. There is one difficulty about my addressing you on this subject and it is the difficulty of the soil.

COAST LANDS TOO LOW FOR BEST RESULTS.

Personally I may be wrong but I do not like to think that in these lowlands where you are likely to have heavy rainfall, even with drainage that you can get the best possible results from pine-apple culture. You may do very well but you will not get the very best results. I think some of the plants I have before me are indications of that, from the form of their growth, the colouring and the roots, but there are parts of this colony which some of you may not know, and I think the sooner you know them the better for your health and the better for the colony's sake, where certain articles which it is difficult to grow down here will thrive and prosper for the material advantage of the people who grow them and also for the benefit of the balance of the people round about Georgetown who would consume of them. I refer to the highlands of the North-West District.

SOIL IN THE NORTH-WEST DISTRICT THE MOST FERTILE.

To my mind the soil of the highlands of the North West District is about the most fertile you can get anywhere in these tropical parts. It is rich soil and well drained and pine-apples will not grow well except in well-drained soil and they will do best if in that soil there is some amount of sand—sandy loam we call it. If, however, you are likely to be deluged with water, your results will not be good and I would never recommend that you should cultivate them as a large business enterprise because it would hardly pay, but given suitable soil I would venture to think that pine-apples will pay if you get the right variety, better than any other article that is cultivated in this colony, not excepting sugar, (applause,) even with the consequential products such as molasses, not to speak of rum.

The pine-apple is very prolific. First of all if you get the right kind of soil you will have to plough thoroughly, digging fairly deep down and turn the soil up well. The soil must be soft and not in big lumps. It must be thoroughly turned up and, as was mentioned a while ago, I think by the Chairman, it is true of pine-apples as of every other form of agriculture, you must plan out your cultivation and plant in straight lines. One reason for it is that you get very many more to the acre and you know exactly how many plants you have put in and you can calculate the results very much better. When you have prepared your soil the best way is to plough up the whole of the land. If you can do that, you can plough in rows of about twelve inches wide in a straight line and as far as the depth is concerned you want to get down to nine inches at least, so that it involves some amount of hard work but the results you would get would quite amply repay the trouble. When you have done that you should put your plants in, if it is good soil not nearer than two feet square and if your soil is good indeed I should say three feet square. I am speaking by the book. An important consideration is the selection of your plants. As you know, the pine-apple tree bears only once and under the best advantage, when the plant has borne fruit there comes out around the sides of it, suckers, You do not get prolific suckers from old plants. (The speaker here demonstrated how to remove the suckers from the parent plant which he characterised as being very important and the manner in which they should be planted and the time of planting which he pointed out should be just before the rainy season.) It is very important that you keep the cultivation clean. It is essential in all kinds of cultivation that it must be kept clean of weeds. The plants must not be smothered at all and in cleaning them out you must be careful that there is no pushing or moving about of the plants themselves. You keep them clean and the next year you begin to get fruit. You get one fruit from each plant, but that is if you have the right kind of pine-apple. That would go very largely to defray the cost of your cultivation and ought very nearly to cover it. If you are doing an export trade it would probably cover it. The next year you are going to get two or three pine-apples where you stuck one in the year before. If they are healthy plants you are going to get two or three healthy suckers coming up. Some vigorous plants would produce perhaps half a dozen suckers. It does not do in the second year to have more than two or three, and if the plants are not healthy you do not want more than two. Still keep them clean and if the soil appears to be getting hard, soften it with a fork and the next year the number of pine-apples you would get would depend on the number of suckers you allowed to fruit. In good soil that would keep on for four or five years without the plants growing up out of the soil, I come to

THE QUESTION OF VARIETY.

There are several varieties, some are ornamental, some are useful. There is one, the best of all which you have in British Guiana, a fruit in Jamaica which we know by the name of Nasbury, which is an adaption of the Botanical name called Sapodilla known here as the Montserrat. That is the most prolific of all, the best flavoured fruit, and also has the best keeping qualities. You can send them on a fourteen or fifteen days' voyage to England; if they are put up in crates, carefully handled, none of them would be spoiled. I am speaking of sending them not on these modern ships with refrigerators but on the ordinary steamers like the Royal Mail which used to travel between the West Indies and England. My view is that if you are going to undertake an industry of any kind, it does not involve any extra expenditure or labour if you deal with the best variety of the particular plant you are going to cultivate. It is the cheapest in the long run, you get better flavour, more prolific plants and good keeping qualities. If you are selling them in the local market it does not matter very much. In the old days in Jamaica they used to be sent to New York and London and Glasgow in flour barrels which were ventilated by having each alternate stave cut away about half and the heading on each side opened. They could pack a barrel with 30 to 40 good fruit and pack them tight, and they use to arrive in perfect condition. Now-a-days they ship them in crates. I am not a believer in crates, for the reason the pine-apple is a very delicate fruit and requires delicate handling, and when you are dealing with a barrel it is easily handled and easily rolled, whereas the crate is an awkward thing and if pushed about it comes down voilently on the ground and the fruit gets bruised, however tightly you pack them. It would be advantageous to find out some better means than crates to ship your fruit. They kept without any refrigeration machine for two and a half weeks on a voyage to England in pre-war days. I have known these pine-apples, I am speaking of those cultivated under the best conditions, being shipped abroad to England and the United States giving a net return of £100 per acre and that is why I say it is a mode or form of agricultural industry that probably will pay or or ought to pay better than anything else, but it requires the greatest possible care. Every part of the process requires the greatest possible care. There can be no scamping of the preparation of the soil or of the landing of the plants or of keeping them clean. I do not know what price they will fetch to-day. I think they would do better here. Again there is the question of

Co-Operation Among Small Proprietors.

It may be that the man who can grow half an acre or an acre cannot afford to ship them. He has not got agents abroad to whom he can consign them, but I venture to think that if the industry is seriously undertaken in this colony and if merchants here find that the fruit is being grown on a large scale and that there were people cultivating the pineapple properly and producing them as they ought to be produced they would pay good prices for them. If the merchants get fine fruit they would ship them and everybody would benefit as the result. I would suggest that some endeavour might be made in that respect. You are having a Farmers' Conference. A conference does not mean speeches and " talkee-talkee" which ends in forgetfulness when we depart for our homes. It means that we meet together to discuss problems, to find a way of handling the subject, the best way of dealing with a particular thing. We confer together and as the result of the conference we arrive at a conclusion with regard to a particular industry that the best way of handling it is to do a certain thing in a certain way. After we have discussed and arrived at that conclusion then it behoves us to go away and put that into practice. If you were to put into practice what has been told you by the Chairman and what has been so well put to you by my learned friend, who would no longer apologise for being a lawyer, I am sure you would go a long way towards being better off and in the doing of it we would depend largely upon ourselves.

I should like to say and I should say it has struck me that in this colony there is just a little too much dependence on what Government ought to do and what Government should do. I cannot help it. I think it is so. I will tell you why. Because I have come from a country whose prosperity, whose very dependence is on agriculture and the Government played no part in the introduction and development of any of our big agricultural industries. (Applause.) They never did it with banana which is one of our big industries, they have not done it with coffee—the Blue Mountain coffee commands the highest price in the world. It might be of interest to my learned friend to know that with the cattle industry we proceeded in Jamaica very much on those lines wanted by him. We have a number of Heresfords, Jersey, Angus and other cattle imported into the Island but not by the Government or the Agricultural Department. Horse-breeding is one of our great industries, and I think that the department of Arigculture there, so far as I remember, had three thoroughbred horses and private individuals must have within the last ten years imported a few hundreds. Might I suggest that if we begin to strive for ourselves we can do a great deal, and as I said a while ago, we can then say this is not a question of experimenting to see if we can rise to the occasion, but we have shown what we are capable of doing and we now ask Government to give us a helping hand. I may say you can then claim it as a right.

I need not mention how glad I am to be here this evening to address you. I hope there may be some attempt to grow pine-apples and if I can do anything from a practical standpoint in the way of instruction I would be glad to do it whenever possible." (Appplause).

Hon. F. Dias next addressed the meeting on the possibilities of the West India Conference and pointed out that agriculture would form one of the subjects to be considered by the Conference in future and that the appointment of Mr. Nowell as Director of Science and Agriculture of the Colony was influenced by the desire to have a skilled agriculturist at the head of that department.

Hon. R. E. Brassington addressing the meeting on "Cane-farming" stated that as much money could be made from the growing of the sugar-cane as from growing the pine-apple. In growing the sugar-cane the three necessities were

(1) hard and steady work; (2) intensive cultivation and (3) co-operation between employer and employee. He had always been a firm believer in the future of the sugar industry of the Colony, and also that the day would come when the sugar-grower would be able to offer bigger prices to the cane-farmer and would be able in other ways to make cane-farming attractive. He was not only interested in cane-farming but in the cultivation of coconuts and of rice as well, They should ask themselves why they do not produce more rice, sugar and coconuts. Take Hawaii with a population of only 10,000 more people than this colony, they produce 600,000 tons of sugar which is six times more than is produced in this colony, and 1,600.000 pine-apples besides exporting rubber and banana and sisal hemp. It might be asked how they achieved that, the answer is, by steady and continuous labour, by a magnificent system of irrigation and by the most up-to-date implements and machinery both in field and factory. They, in the sugar business were trying under great difficulties, because at the present moment the cost of producing one ton of sugar was greater than the selling price. They were trying to put their house in order, to instal up-to-date machinery in the factory which meant more money for the grower. With drainage and irrigation, steady market and improved machinery one might well consider that there is something to be made in cane farming. He was very pleased to be there that evening and to address them. If his life be spared to visit that part of the colony again he hoped to hear a very encouraging report, not only with regard to the rice industry which was raised up by the indomitable spirit and patience of the East Indians in the face of great difficulties, but to farming generally. It was hard work and reliance on themselves which was the road to success. (Applause).

Mr. Walcott was also asked to address the meeting but declined on account of the lateness of the night, remarking that he would have an opportunity to do so at a later date.

Mr. Fredericks was next requested to address the meeting and gave a humorous summing up on the points raised by the various speakers who had preceded him.

A vote of thanks by Mr. Z. Peters and seconded by Mr. O. McGarrell was unanimously accorded the chairman, and the speakers, after which the meeting terminated with the singing of the National Anthem.

RUBBER COAGULANTS.

We learn from a trustworthy source that the Department of Agriculture, Straits Settlements and Federated Malay States, has recently had under consideration the question of the use of alum as rubber coagulant. A few years ago, owing to reports from United States manufacturers on the quality and especially the low rate of vulcanisation of rubbers coagulated by the addition of alum to the latex, a heavy import duty was placed on alum imported into the Federated Malay States, where up to that date it had been largely used by Asiatic smallholders. A questionnaire has now been sent by the ***Agricultural Chemists*** to a large number of British, European and American rubber manufacturers with a view to ascertaining whether the prohibitive duty on alum should be maintained. Replies received indicate that the reintroduction of alum as a coagulant would almost certainly tend to greater variability in respect of rate of vulcanisation, and they point out that such variability is still of considerable importance in spite of the more extended use of powerful organic vulcanisation accelerators which do not entirely eliminate original variability of the raw rubber. Investigations into the value of formic acid as a coagulant indicates that it is a good and cheap substitute for acetic acid and has no harmful effect on the rubber. The amount required for coagulation is only approximately half that required in the case of acetic acid, so that even at an equivalent price its use should prove an economy.

METEOROLOGY AND AGRICULTURE

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Climate, definable as the average of meteorological conditions over a long term of years, has a predominant influence upon agricultural production. As crops differ in their individual demands for warmth, rainfall, and sunshine, so an excess or deficiency in the requisite quantities of these essentials causes injury and possibly complete failure. Not less important than the requisite seasonal quantities of these meteorological elements is their incidence in the life of crops, since as a general rule there are critical periods or stages in growth at which certain quantities of rain, sunshine or warmth are particularly necessary. Climatic conditions are often found in "zones," the effect upon vegetation being most clearly exemplified in continental regions, such as North America, with its cotton, maize, and wheat belts. In England, as a result of the climatic differences, corn crops are found mainly in the eastern and grassland in the western counties.

In addition to their direct action upon crops, meteorological elements have an indirect influence, bearing chiefly upon cultural operations and upon the pests and diseases to which crops are subject. Obviously, if ploughing, seeding, and harvesting operations have to be undertaken when weather conditions are adverse, the chances of a successful crop are lessened. Temperature and humidity at various periods in the life history of insect and fungus pests are all-important to the development of these pests, the effect being accentuated if at the same time the weather conditions adversely affect the growth of the host crops or bring them to a susceptible state at the right moment from the point of view of attack. The weather, also, indirectly influences crop growth through its effect on the soil, rainfall above a certain amount leading to the washing away of plant nutrients.

breeder, for example, desires to know the critical stages in a plant's growth so that he may breed varieties with characteristics that will render them more resistant at those critical periods (whether to direct adverse weather conditions or insect and pest attacks), or characteristics that will predispose those critical periods to occur at times when weather conditions are likely to be favourable. An outstanding example of fitting a crop to climatic conditions is afforded by the breeding of "Marquis" wheat in Canada ; this wheat matures a few days earlier than standard varieties grown up to the time of its introduction ; these days were critical days, however, and the wheat could be grown in districts with a risk of earlier winters, so that a great expansion of the area under the crop in that country resulted. For the same reason "Marquis" escapes much of the rust which used to ravage "Red Fife" and its other predecessors.

The *worker on soils and manures* desires to know how, with any given soil, the effect of manures both on yield and quality of crop varies with meteorological conditions, so that he may give advice to the practical farmer in accordance with the weather experienced and that to be expected from a study of foregoing seasons. Thus from a study of soil and weather, the soil worker may be able to advise that a dressing of nitrogenous manure applied for wheat in winter will need to be repeated in spring ; that with the prospect of a large spring rainfall, muriate of potash can be equally well applied to potatoes as sulphate of potash ; that, as the summer is wet, basic slag may be applied with every prospect of increased keep from pastures in the autumn.

The *soil physicist* desires to know the effect of meteorological factors on those soil conditions (*e.g.*, soil moisture, plasticity, cohesion, etc.) on which soil tilth depends, so that he may assess the relative efficiency of different cultural operations, both from the practical and economic aspects. He also needs this information to supplement and check his laboratory investigations on the physical properties of soils.

Apart from its intrinsic value to soil science, this knowledge is of the greatest importance to the ***agricultural***

To a limited extent it is possible to modify climatic influences locally, *e.g.*, by draining marsh land ; by cutting down forests ; by irrigation to counteract deficiency in rainfall ; and by the use of smoke screens, artificial heat or flooding to guard against frost. Certain crops, also, such as glasshouse crops, can be grown profitably under artificial conditions that make them almost independent of climate. In general, however, it is true to say that there is no possibility of so changing climate as to render it more suitable to particular crops. Such crops and their varieties must be chosen, and farming operations so ordered, therefore, as best to support the existing climatic conditions.

USE OF METEOROLOGICAL OBSERVATIONS IN PRACTICAL AGRICULTURE.—The crops and operations customary in any given district have been adopted, presumably, after long experience based on past successes and failures. It is impossible, however, to be certain that such crops and operations are indisputably the best, because one cannot be sure that all alternatives have been tried, a consideration which gains in importance when it is remembered that modern agricultural science is ever placing fresh discoveries before the farming public. The practical man should know within a reasonably short time what farming practice can be adopted, what new crops can be grown, and which of the discoveries made by research institutes can be put into operation in his own particular case with chances of success. As a recent example may be cited the introduction of the sugar beet crop, in the case of which the weather conditions which favour good yield and quality must be known and compared with those obtaining in a district in which its introduction is contemplated.

Careful and detailed data relating to meteorological conditions experienced throughout the life of crops, and their effect on growth, are thus required if new agricultural practices and the results of agricultural research are to be given their full value.

USE OF METEOROLOGICAL OBSERVATIONS IN AGRICULTURAL RESEARCH.—A study of meteorological conditions is necessary for the carrying out of research. The *plant* *engineer*, as it enables him to base his implement designs on definite information in place of empirical observations. Detailed local data regarding rainfall, humidity, temperature, sunshine, and wind are directly of value to the agricultural engineer in investigations of the use in agriculture of water and wind power and of drying apparatus.

The ***plant pathologist*** is concerned with the effect of climatic conditions on insect and fungus pests in order that control measures may be devised, and, as a result, and with observations of meteorological conditions at any place and time, practical growers may be advised as to the necessity, or otherwise, of adopting these measures. The value of observations on the effect of weather on outbreaks of epidemic diseases of plants is shown by work in Europe and America. In France and Italy it has been found possible, by careful meteorological crop and pest observations, successfully to forecast outbreaks, and an organisation has been set up both at Montpellier and at Turin for the purpose of warning growers when to spray.

Considerations such as the foregoing show how necessary it is for the advancement, both of the practice and science of agriculture, that careful and detailed meteorological observations should be carried out concurrently with observations on the growth, yield, and quality of crops, their response to manures, their resistance to attacks of insect and fungus pests, etc.

USE OF METEOROLOGICAL OBSERVATIONS IN FORECASTING YIELDS.—Observations of meteorological data, on the one hand, and of crop data on the other, may prove to be of value, among other purposes, for that of forecasting yields of crops. Statistical methods have been evolved whereby, given sufficient data of both kinds, the two can be correlated and the effect of meteorological elements, singly or in combination, on the crop yields ascertained. It may therefore be possible in future, by using the meteorolcgical data collected in any season and applying "correlation coefficients," worked out by statisticians, to estimate the probability that the crop yield will be above or below a certain amount. This aspect of agricultural meteorological work is the one above all others that has made a special appeal abroad. The value of forecasts is likely to be increased proportionately to the length of time that they can be made in advance; the date at which they can be made depends, of course, largely on the times of critical periods in the crop's life. One aspect of crop weather forecasting, which has received some attention in the past, is that of weather cycles or periodical repetition of weather conditions; such cycles are stated to have been discovered, and the search for fresh ones is being pursued. Other things being equal, repetition of meteorological conditions may be expected to lead to reproduction of agricultural phenomena.

PHENOLOGICAL OBSERVATIONS.*—In addition to the observations on plant growth and plant pest appearance, required under the agricultural and horticultural parts of the scheme, various stations have responded to an invitation to collect additional phenological observation: these observations are the date of flowering (or other growth stage) of any or all of 21 wild plants, shrubs, and trees. The observations are made year after year on the same bush, plant, or association of plants, growing under average conditions (*i.e.*, not very sheltered or very exposed), well established. In selecting the plants to be observed, preference is given to species growing in the neighbourhood of stations where observation under the Agricultural Meteorological Scheme are being recorded, and which are familiar to farmers and, possible, to other individuals.

It may be explained that the effect of all the meteorological elements making up the character of the season can be expected to be summed up in such plants as have been selected : these plants may be termed indicator plants, and they show whether the season is early, normal, or late. Observations of this kind have been summed up in the United States in a "bio-climatic law" of latitude, longitude, and altitude, to the effect that the climatic variation in plant development is some four days to each degree of latitude and to each five degrees of longitude, and to each 400 feet of altitude, the phenological dates being later northward, eastward and upward in the spring and early summer, and the reverse in the late summer and autumn. Good use has been made of these phenological observations in regulating farming operations and in combating pests (*e.g.*, Hessian fly).

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* Phenology is that branch of meteorology which treats of climatic influences on certain recurrent phenomena of animal and vegetable life.

In addition to the data specified above, diaries are kept at the stations for the purpose of recording day by day the observer's own impressions of the effect of weather on crops. When the material (meteorological and biological), collected under the Agricultural Meteorological Scheme, is available in satisfactory form for a sufficient length of time, arrangements will be made for it to be subjected to rigorous statistical examination with the object of determining the effect of meteorological conditions on the growth of crops. It is hoped, also, to place freely at the disposal of investigators interested in one or more of the various aspects of the work, all the material available. During the time that the scheme has been in operation, monthly reports have been issued summarising the data collected at the various stations, and copies of these reports may be obtained free on request from the Ministry of Agriculture and Fisheries. It is further hoped that the observers at the different stations will keep in mind the objects for which the observations are made, and utilise them whenever opportunity occurs in their own districts. Exceptional occurrences, like long droughts, heavy floods, unusual lack of sunshine, etc., must express themselves on crops and stock, and may produce effects after long intervals that an ordinary monthly comparison will not disclose. There is also the question of the recovery of crops from adverse conditions, which cannot very well be scheduled but may be of real importance and interest to those who are in daily touch with the facts.

The agricultural meteorological scheme of the Ministry is in the charge of a committee, of which representative meteorologists and agricultural, biological and statistical workers are members.

EFFECT OF WEATHER ON ANIMALS.—The writer has failed to discover that much attention has yet been paid, in foreign agricultural meteorological schemes, to correlating the meteorological data available with data relating to animal husbandry. Climate has obviously been as important in determining the fauna of various districts as it has the flora. Obviously, crops have an important influence on the animals feeding on them, so that climate will affect animals indirectly through crops. It must, also, have a direct influence. Temperature and humidity, necessarily, have considerable effect on the *health* of animals and on the pests to which they are subject. Temperature must affect the *rationing* of animals for the production of meat and milk, and weather conceivably affects the composition of milk ; the effect of sunlight, even, has to be considered in connection with the feeding of animals. And, as regards *breeding* questions, it seems that meteorological conditions influence fertility (at least of sheep ;) and artificial lighting (quite apart from effects on health and rationing) may also influence fecundity. The effect of meteorological conditions on the animal husbandry of the country appears therefore to offer a wide field for study.—*Abstracted from the Journal of the Ministry of Agriculture, Vol. XXXIII., No. 4.*

BOTANICAL NOTES.

By Edgar Beckett, F.L.S.

SOME FIBRE PLANTS.

It is a well-known fact that most of the species of the genus ***Urena*** yield fibre of importance. ***Urena lobata*** is a common shrub in this Colony and it is found in the three counties. It was possibly introduced here from India. It yields a strong fibre and one which probably might be utilised in the manufacture of rice bags or even sugar bags.

It is interesting to read that "slips of sized paper weighing 39 grs., made from this fibre, sustained 75 lbs. as against Bank of England note pulp 47 lbs.; it was said to bear ink well, but to work "woody "and hairy" Spons.

An experiment in connection with this plant on a considerable scale is now being carried out in the colony, by a firm interested in fibres.

Crotolaria juncea, Sunn Hemp, grows rapidly and well in this Colony and may be seen in some gardens in the city. Of course, it is one of the commonest of plants in India.

It is stated that in the Punjaub, there are 50,000 acres under this fibre-producing plant. It yields an excellent fibre which is exported from India as 'hemp. The cordage made from the fibre is exceedingly strong. According to Spons, experiments shewed that its breaking strain was 407 lbs.

When one remembers the enormous quantities of rice bags that are imported into British Guiana, not to mention sugar bags, it would seem as if it would be worth while for some one to turn his thoughts towards the possibility of utilising some of the plants which are either indigenous, or naturalised, and which produce fibre suitable for conversion into gunny sacks, Certain of our species of Hibiscus yield quite good fibre, whilst the fibre from the wild Ochro, ***Malachra capitata*** is, when properly cleaned, most attractive, and is from 8-9 feet in length. This fibre might rival that of Jute.

Sesbania aegyptiaca is a common weed with us—this also yields a good strong fibre, in fact it is said to yield a fibre superior to Jute(*Corchorus*). We might also find that Tibisiri—the fibre made by our aboriginal Indians from our native palm ***Mauritia flexuosa***—might furnish more than hammocks.

Our common MonkeyApple (***Anona palustris***) is said to yield a fibre of value, whilst our various ***Ananassas*** or ***Bromelias***, it is well-known, furnish fibres which are not to be despised.

The whole question concerning the possibilities of our vegetable fibre producing plants is one which will well repay close attention and experiment.

PAPAIN.

Carica papaya grows throughout this colony so readily, that one might apply the term wild, to it growth. We have, on occasion, tapped the fruit of the papaw and dried the latex — a good price was obtained for the product, Papain.

It is important that the fruit be tapped with some instrument, other than one made of steel, and that the latex is caught in a clean porcelain vessel and dried in the sun. It is well-known that its proteolytic virtues aid largely in digestion.

We refer to the possibility of our farmers building up an industry in Papain, as we understand that at present there is a shortage in the supply of this ferment. The writer will be very pleased, at anytime, to show farmers how the product should be prepared.

FIRE WOOD.

For these persons who own land, within easy reach of Georgetown, we believe that quite a respectable income could be made by planting areas of *Casuarinas*, *Casuarina equisetifolia* grows readily in this Colony, even in fairly heavy clays. The calorific value of the wood is extremly high, and we believe, quite an extensive business in supplying cheap and excellent fuel to Georgetown, could be carried on.

The trees can be planted quite closely, 6′ x 6′ would give 1,210 trees to the acre, so that an area of 10 acres would mean a total of 12,100 trees.

At the end of four to five years, every other tree might be cut out and sold, two years later a further 200 trees per acre can be removed, and at the 8th or 9th year, the whole area cleared.

A decent income might readily be realised from this.

With the large areas in this colony not beneficially occupied, a respectable acreage might easily be planted out.

The Sugar Estates authorities also might find it an advantage to cultivate this valuable fuel tree.

In Madras there is considerable activity in the growing of casuarinas—so much so that, a line of railway has been established to transport this wood. The erect habit of the tree, its hardy nature, and the ease with which it is cut, added to its high calorific value, make it an ideal tree for furnishing fuel.

An export trade might be developed, in time, with Barbados, and those Islands, where fuel is scarce.

THE ROOT GROWTH OF PLANTS.

Lecture delivered by Major Caws at the Half-Yearly General Meeting of the Associated Branch Societies of St. Thomas.

It was certainly very flattering to an amateur such as myself to receive Mr. Buckley's invitation to read a short paper to a meeting of experts in agriculture, and I only consented as I felt I should like to submit for your consideration the result of some slight investigations of mine in what is certainly a very important branch of study.

Perhaps what I have to say may better be described as "Suggested Improvements in cultivation to secure better conditions for the root growth of plants." I do not know if your experience is mine, but from many conversations I have had in different parts of this island with those who get their living by tilling the soil, I have formed the opinion that the underground growth of the plant is a subject that has received little attention. I have, for intance, asked perhaps one hundred Jamaican peasants how far they think an Irish potato will send its roots, in suitable, deeply cultivated ground, and I have received all sorts of answers, from four to ten inches, the general answer being "about seven."

In an article by Luther Burbank, the "plant wizard" of America, which I read recently, he speaks about a potato under certain conditions sending its roots 30 feet. And I well remember reading of some experiments in France in 1897 in which a French scientist cultivated ground to a depth of two metres, or nearly seven feet, and traced Irish potato roots to over one metre, or say 3 ft. 6 ins. below the surface.

There is also the carrot. I have made the same enquiry of the same sort of people and I never yet got anyone to tell me that the carrot runs down more than fourteen inches. But in 1921 I measured six carrots, in a bunch, which took the first prize at an Agricultural Show in England and they averaged 27 inches. The roots had broken off at about an eighth of an inch thick, so that remembering that those same roots run down till they are of the thickness of a piece of cotton thread, it is probable that the extremities reached to five or six feet below the surface. If that is thought an exaggeration I would like to tell you of an instance recorded by Mr. Mechi, a well known English farmer of eighty years ago. Some men were breaking down brick earth in a field that had the previous Spring been sown to parsnips, which have just the same root growth as the carrot. The methods of doing this ensures a vertical face of earth of anything up to 15 or 20 ft. according to the depth of the underlying gravel. The man noticed, after a fall, that a parsnip which had been mixed by those who had dug the crop, was left half in the vertical face of earth and half out, and one of them was intelligent enough to call Mr. Mechi who records that he traced the root to a depth of 13 feet and 6 inches, and that it broke off. The turnip follows the same rule and I saw an instance, quoted in an English newspaper a few years ago, where turnip roots had been traced 5 feet down.

Onions have been traced for four feet. In 1912-13 some large underground tanks were put in at one of the outlying forts in Kingston harbour, where the formation is the well known honeycomb limestone with deep pockets of soil. I saw several roots of large trees (most of them the Jamaica birch) down at 16 feet from the surface, and I am not sure that we ever saw the end of the deepest.

So much for the depth to which roots will go, but what of their lateral spread ? Most of you must have noticed in the Journal for April a very interesting "Seasonable Hint" which spoke of the small jungles we see everywhere in Jamaica with coffee trees three or four feet apart and six or eight feet high, the boughs being interlaced, and the crop a dozen or two dozen berries and sometimes not that. What of the roots ? Well, having read that item, on 13th May to be exact, I went to a coffee tree near my house, which stands about ten feet from the nearest tree. I dug down at 4 ft. 6 ins. from the trunk (which I may say is about 2 inches in diameter) and cut through a tangle of roots. So I extended the hole away from the tree, and worked out the ground on each side of it, finally finding the end of the longest root at that point at 5 ft. 9 ins. from the tree, and the average of five or six roots proved to be 5 ft. 7 ins. What chance therefore have the trees in the jungles referred to ? Their roots must be much more badly interlaced than the branches overhead, each robbing from the other and literally choking the life out of the neighbours. And, as to three or four feet apart I may observe that that is a very liberal estimate in many instances; and I know several places where the distance is much less, perhaps the worst being about two miles from Trinity Ville where four trees are growing on less than four square feet.

The London Police consider a packed crowd to be one which carries eight people on the square yard. There appears to be no reason why any coffee tree in Jamaica should emulate a packed crowd in London; but this is what those trees are forced to do: and again I ask : What chance have they, when they cannot send their roots six inches without meeting those of another tree ?

Another intance of lateral spread is the yam root. Last season I had a competition with my headman. We picked out two white yam heads, as nearly as possible the same size, and I gave him the first choice. He knew more about it than I, for the one he picked out had two good eyes, end mine had none, so that his got a clear fortnight's start of mine, and had its vine several feet up the stick before mine was out of the ground. He dug an ordinary hole and made the customary small oval hill, while I dug a hole about 3 feet in diameter and about 2 ft. 6 ins. deep. I am ashamed to say that up to July 1925, I did not know the root system of the yam plant and that all its important feeding roots are laterals. Had I known this I should not have carried out the experiment where I did as the ground we planted in had been dug twice in the previous eighteen months, and I only dug my hole six feet from the other. I treated the hole better than the surrounding ground, filling it up with the surface earth, mixed with a well rotted manure and old broken-up brick and powdered lime mortar. In addition I put a mulching of manure and grass over the surface for about three feet each way from my plant. At the end of July, about nine weeks after planting I had occasion to pull out a plant growing at the edge of the hole in which I had put my yam, and found to my surprise a root, which evidently did not belong to mine. I traced it both ways and found that it came from the headman's plant, that it was over 8 feet long and hadn't yet done growing. To complete the story of this experiment I found that the headman's yam took full advantage of the better soil in which mine was planted and had a network of roots interlaced with mine, which no doubt set mine back to the profit of his. So I only beat him by about 14 per cent., his yam weighing 31½ when dug, while mine weighed 37 lbs. If, however, he had been 20 or 30 feet away, planted in a hill surrounded by hard soil, without the benefit of the better ground which surrounded my plant, who can doubt that I should have beaten him by 25 or 30 per cent. We are having another competition this year, six roots each. Mine are eight feet apart, with the ground forked between them, and his are the ordinary four feet, but the two lots are sixty feet from each other, so that anyhow he will not rob from me this time.

I think we shall be agreed that the facts I have stated indicate the necessity of deep digging and wide planting. Of course I do not suggest that we should try to cultivate to the depth of Mr. Mechi's parsnip, but certainly if we are to get better carrots and turnips than the little things I see being brought into the towns from the country parts we shall have to loosen and ærate the ground to a much greater depth than is now being done.

And that brings me to the question of the necessity of getting the air into the soil and sub-soil. Fortunately, I am able to tell you of some experiments carried out near the town of Dorking in the County of Surrey, in England, by Sir Arthur Collins, an old retired Indian General. Sir Arthur had in his young days come into contact with the Lord Tweedmouth of his day and had learned from him certain facts as to root growth. He had never forgotten his lessons, and he always took a very keen interest in agricultural matters. He observed that while a farmer was content to plough his arable lands to a depth of five or six inches he was wiser when it came to his vegetable garden. In that small patch he would double spit the ground to a depth of perhaps eighteen or twenty inches, and would get much better results than those of the open field. So the old gentleman determined to test the matter out for himself and to keep accurate records, and this he did over a period of ten or twelve years. He certainly got some most extraordinary results, and by pulverising the soil to a depth of two or three feet he grew phenomenal crops. His crop of wheat was seven times the average of all England—an increase of 600 per cent. In Irish potatoes he planted sets,—two to three ounces in weight, one to a square yard—that is three feet apart in the row, and the rows at three feet intervals. He got 14 lbs. of marketable potatoes per plant, which at the rate of 1d. per lb. is £280 sterling per acre. (I myself following this method got tremendous plants, covering in the whole area, although planted three feet each way, but my crop was only 8 lbs. per root. Still that at 1d. per lb. would give £160 per acre.) Perhaps the most interesting to us of all Sir Arthur Collins' experiments was one in which he grew fodder grass in 1893. I well remember that year, for at the station in England where I was then serving, I kept certain records, and from a date in February (I think 22nd onwards) I recored over 100 days of bright sunshine. Sir Arthur says that by 1st June there was not a blade of green grass in any of the fields around about him, the hay season being the worst for a century. Yet on that day he cut his crop five feet high, giving him 4½ tons of hay to the acre and he got two subsequent cuttings which gave him three tons more. That stand of grass was cut for seven consecutive years, as against two years which is the common experience.

Sir Arthur proved that deeply-tilled soil is always damp at six inches below the surface, even in the worst drought known in England, and that when the ground is loosened to let the air down freely the roots will follow and will get down beyond all chance of being dried up. Another great improvement noticed was in the nitrification of the soil. He points out that tropical soils are often very rich in nitrogen—sometimes as much as one per cent. being present but that is not in a form easily available to plant life. Aeration assists greatly in making this available.

When Sir Arthur began his experiments he always manured the ground but at the end he came to the conclusion that the all-important thing is to get air down well under the surface; and that deep digging without any manure at all, produces better permanent results than shallow digging with manure. We know now why this is, and that the little organisms which fix the nitrogen in the soil, must have the air brought to them, or they cannot do their work. He also found that such sort of soil needed different treatment. In the case of heavy clays it would be fatal to dig eighteen inches and plant straight away in the sour ground. So he put a guard on the fork, and increased the depth of digging an inch ot two every year, thus only bringing up a small extra quantity in 12 months, to be ærated and sweetened by the fresh air and sunlight. It therefore seems clear that root growth is immensely helped by a proper preparation of the grovnd. If the earth be loosened up and sweetened by letting in the fresh air a root will most certainly have less trouble in penetrating the soil, and less strain will be brought on the plant, although more nutriment will be conveyed to it—advantage being thus secured both ways. And this brings me to the reason, which, I think lies behind the sweet potato hills, which I see everywhere in Jamaica. I have never seen either hills or ridges in Bermuda, where they grow very fine crops of sweet potatoes, and I understand the hill is unknown in Cuba. I do not doubt that the dug and loosened-up soil enables the root to run easily and that it was the observation of that fact which led to the making of the hill. But from my own observation the roots of the plant run far beyond the hill, and as the space between the hills is left as a sort of wall of solid ground, that has been beaten by the tropical drains, an baked by the tropical sun into a species of concrete, which the roots have to force their way through, it seems, certain that a strain is brought upon the plant that must retard its growth. I mean to test the thing out by definite experiment and to plant two measured plots of ground, side by side, each about a square chain. I will communicate the results of that experiment to the Society's Journal all being well, next year. I can, of course, see a sort of reason for the hill in swampy or waterlogged soil; but on a hillside, where there is natural drainage, or in sandy soil, it seems to me that trouble is being asked for when the hill is being made especially in dry season; for just as the area of a basin is greater than the area of the circle which is bounded by its rim, so in the case of a hill is the area from which moisture may be evaporated greater than the area of the flat ground under the hill.

I will close my remarks by describing a method I am adopting this year in the planting of yam. Of course, in departing from old established practice (at least in St. Thomas) I may be making a mistake but after the experiment I have already described, I propose to follow the course which the habit of the yam plant seems to indicate in the case of the Negro, White and St. Vincent varieties. There are some sorts which seem to object to having life made easy for them, such as the Renta and Barbados yams together with the Yampie. These seem to follow the men of the rugged North and to do better when they meet with opposition. But in the others I have mentioned, I notice that if the hole be dug shallow, it is easy to see from the yam tuber where the soft ground ended and the hard began. At that point there is a restriction, a sort of toe is formed, which differs from the rest in shape, colour and density. For these sorts I think a hole should be dug deeper than the tuber is expected to reach to, so that it may not meet with any check in its developments, and I am therefore digging my holes three feet deep. And then as to the lateral surface roots on which the plant depends for its food I am digging the holes three feet diameter, and putting them at eight feet centres, so that they may be a clean four feet before any other roots are reached. Eight feet has been selected because ultimately the area will be in coffee, and that spacing has been shown to be best for coffee at this level. Next October a coffee sucker will be planted next the yam now being put in, and next year a yam will be put in the intermediate space between the young coffee. In addition to the wide holes I am forking the whole ground between, so that the yam laterals may run freely. This forking, I find, ought to be done within ten days of planting, as otherwise the roots from the new plant may be broken off. The men who are doing the work say that they could never afford to plant in this manner, but the total cost is only 4d. per hole, or say 3d. to 3½d. more than the old system. If I get only 3 lbs. of yam per hill more than the old way I shall get back the cost as well as having my ground deeply tilled. I propose to mulch the ground heavily (all but a circle of eighteen inches across at the plant) and in September and October to plant by means of a pointed stick through the mulch red peas at twelve to fourteen inches apart, cutting off the plant at the time of reaping and leaving the roots to rot in the grounds, thus providing a vertical tube for additional aeration and percolation of water. Only time can tell whether the experiment is or is not on sound lines.

I hope that this short paper may give some of us a little food for thought which is a thing badly needed in Jamaica. What we want more of, is thinking by you men of practise, and the better and more accurate recording of ascertained facts.—*Journal of the Jamaica Agricultural Society, Vol. XXX., No. 7.*

MINERALS IN LIVE STOCK FEEDING.

By Geo. B. Rothwell,

Dominion Animal Husbandman.

Much has been written concerning the subject. Many advertisements appear descriptive of the virtues of commercial mineral mixtures. In a general way, it is difficult to prescribe mineral supplements for live stock. Almost as well try to prescribe plant food in the way of fertilizers without knowing the nature of the particular soil to be fed, and in particular the chemical analysis (as disclosing the deficiencies) of same.

The kind of stock, the age, the kind and quantities of food fed, the nature and analysis of the soil growing all or a part of this feed, whether or not abnormal characteristics (deficiency diseases) appear regularly in the animals so fed—these are some of the factors concerning which knowledge is necessary before authentic information may be given. In this connection, deficiency in, say, the lime content of a soil is popularly supposed to result in a similar deficiency in the lime content of the plant, further reflected upon the condition of the animal consuming the plant. To a very limited extent this is true. The point is that while there is relatively little variation in the lime content of fodders, irrespective of the soil mineral content, and that the crop will lack in yield rather than constituent—the crop grown on a deficient soil tends towards the low range in the lacking soil constituent, and continuous feeding of such a fodder may ultimately reflect this deficiency on live stock consuming it.

Roughly speaking, the animal body contains the same ash materials as are found in plants, and, as a general rule, the elements essential to the life of plants are essential to the life of animals. Without going into a dissertation on the mineral composition of plants and animals, let it be stated that calcium, phosphorus, potassium, magnesium, sulphur and iron are possibly the most important elements as found in the plant and as required by the animal body.

Of these, calcium and phosphorus are of prime importance, and mainly through lack of these, unsatisfactory conditions (as caused by mineral deficiency) are found in live stock.

Under ordinary conditions, as already stated, where the ration has fair variety and adequate quantities are fed, there is little danger of lack of mineral. The results of feeding ill balanced rations, insufficiently supplied, cannot be overcome by feeding supplementary mineral mixtures. Correct feeding of the soil, the featuring of leguminous crops (clover and alfalfa), the following of good feeding practice and the regular supplying of common salt, all are important in this connection.

Nevertheless, the use of mineral supplements is in many cases, good practice, particularly with dairy cattle, pigs, and pregnant or nursing females generally. With the latter a ration high in lime and phosphorus is required. Then, too, the nature of the feeds available may make necessary certain mineral additions to the ration. For example, some of the common feeds low in lime or calcium and calcium phosphate are straw and chaff, cereals and their by-products and roots. On the other hand, feeds high in lime are, hay from legumes, alfalfa in particular, certain grasses and many of the leguminous seeds. The small grains, wheat bran, malt sprouts, brewers' grains, linseed meal, etc., are all high in phosphoric acid.

The following figures are significant, as disclosing *the calcium content* on a dry matter basis of certain roughages: *alfalfa 2.5 per cent*, red clover, 1.58 per cent; timothy hay, .39 per cent; corn stover, .41 per cent; oat straw, .36 per cent; wheat straw, .22 per cent.

From the foregoing brief comments, it would appear that, within certain limits, the feeder may control the mineral constituents of his live stock rations through the feeds he grows and uses.

There follows a brief discussion of mineral constituents as applying to the ration of the different classes of stock.

Horses.—Show fewer conditions attributable to mineral deficiency than other kinds of farm stock,

1. Salt regularly.

2. Ground or pulverized charcoal may be very useful. Feeding a handful or two during the week in grain or mash supplies phosphates and a good digestant at the same time.

3. Lime may be needed in some districts, and may be administered as ground lime stone in feed or as in lime water in the drinking water.

4. Potassium iodide crystals administered at the rate of one-eigth of an ounce (one small teaspoon, level) on the first and fifteenth of each month, dissolved in drinking water, would appear highly beneficial in the case of infoal mares as a preventive to joint ill and weakness in foals. Start administering this in November with the spring-bred mare.

Cattle.—Very frequently are insufficiently supplied with minerals, particularly high-producing dairy cows.

1. Feed a well balanced ration, making the feeding of leguminous roughages (alfalfa if possible) a feature.

2. *Supply salt regularly.* Iodized salt has special virtues. It may be purchased in block form or made up —two to four ounces potassium iodide dissolved in water and sprinkled over one hundred pounds of dry salt. Mix thoroughly.

3. *Edible bone meal* (not fertilzer) or bone char, where it may be secured, forms an excellent source of bone phosphate. Feeding a pound to a pound and a half per hundred pounds meal is good practice and may effectively supplement the heavy demands of the high-producing cow.

Where cattle show an abnormal or depraved appetite for bones, wood, etc., the result of deficient ration, this condition may be gradually corrected by the use of a mixture of bone meal, ground charcoal and salt. Further, there is considerable evidence pointing towards the probability of assistance from supplementary bone meal feeding in the matter of abortion infection control. If so, this must come through the strengthening or toning of the system generally and the genital organs in particular.

4. ***Pulverized charcoal*** or chick size charcoal may be fed to advantage, one and one-half to two pounds per hundredweight of meal. Charcoal is high in phosphates and is a good absorbent and cleanser for the intestinal tract.

5. ***Lime*** is best fed to cattle through leguminous roughages. It may be fed in the form of ground limestone with salt or mixed in the meal.

Finally, no amount of mineral mixture, bone meal, phosphates or lime, will greatly change the condition of the underfed "straw stack" cows, so common. The major consideration in Canada is ***better feeding,*** particularly as applied to calves, growing stock ***and dry cows.***

Sheep.—With one notable exception, sheep, as a rule, have not received or seemed to need the attention given other classes of stock in regard to mineral. Subsisting largely on pasture and hay or roughage crops and having access to the earth itself, their demands seem to be met with a plentiful and continual supply of salt, preferably rock salt.

Of late years, the practice of feeding iodized salt has become common, particularly in Western Canada and in districts where goitre is prevalent. The administration of minute quantities of iodine to the pregnant ewe will control goitre. As pointed out, iodized salt may be purchased in block form or may be made up as already described. The optimum quantity of potassium iodide for use in this connection is not definitely established as yet. From two to four ounces per hundred pounds of salt would seem to give satisfactory results. Thorough mixing is necessary.

A fair proportion of leguminous roughages is just as valuable, as with other classes of stock.

Swine.—The growth of the pig is the most rapid of all farm animals. Frequently the sow produces two litters per year. Therefore, the demand for lime, bone phosphates, etc., is heavy, and not infrequently poorly supplied by the feeder. There is no doubt but that more attention to mineral supply would result in stronger litters, greater certainty in breeding operations, and better developed frames in market pigs.

1. Alfalfa or clover hay should be before the brood sow all winter.

2. The same roughages are good for winter fed market pigs.

3. Sods form one of the cheapest and best forms of mineral matter for winter use.

4. Tankage or meat meal, 3 to 5 per cent. for the brood sow and up to 10 per cent. for the feeder hog where no milk is fed, supplies soluble mineral salts.

5. Bone meal, ground limestone and charcoal make valuable additions to the meal ration of the brood sow or growing pig in many cases. One pound of each per hundredweight of meal may be enough. Edible bone meal is especially good for the brood sow, as is a small quantity of tankage (3 ℔. per cwt. of meal).

6. Where hairless litters are prevalent or feared, potassium iodide is a reliable preventive. Make a stock solution of one ounce of potassium iodide to one gallon of water and give one tablespoonful of the solution to the sow daily in her slop during the greater part of pregnancy. Aside from preventive powers toward hairless litters and kindred conditions, such practice seems to exert a generally beneficial effect on litters.

Finally, in the foregoing discussion it has been impossible to stress the importance of good feeding practice. In Canada, as a rule, poor results with live stock are not directly attributable to lack of mineral in the ration. There are, of course, definite exceptions to this rule. Using the right kind of feed and enough of it to fit the age, kind and condition of the animal is of primary importance.

SOME ROUGH NOTES ON COCONUTS.

By Edgar Beckett, F.L.S.

When one considers the permanent nature of this crop, it is astonishing what little care is given by local growers to points of extreme importance before venturing on planting.

Throughout the whole Colony one sees bad types of trees, diseases of the stem and terminal bud, diseases of the leaves, stems undeveloped and also severely hacked, whilst during certain periods the ravages made by the caterpillar of *Brassolis sophorae* are a marked feature in coconut districts.

Little or no attempt appears to have been made in connexion with seed selection, and correct spacing in most instances has been ignored, whilst beyond brushing down weeds and bush, no cultivation whatever is practised. It is surprising what good crops sometimes are produced in spite of the absolute neglect that is so apparent.

The Coconut palm readily responds to any help that is given it. Usually palms are left to take care of themselves and often it is a case of the survival of the fittest. A little weeding around is given three times, or less, during a year and the young palms are expected to develop into strong and healthy trees, giving good crops. In a colony like ours where no implemental tillage is carried out on coconut plantations, it is to be expected that the growth of weeds can quickly smother a young cultivation of palms. The mere weeding of the surface is the common practise, but this is not of very much use. In most of our coast soils, the fertility is on the surface. It follows, therefore that the roots of the palm have a tendency to come to the surface, and frequently the rough, so-called weeding given, acts as a shock to the whole surface-feeding root system, since there is no actual breaking of the soil at all. Such weeding is not cultivation, and sometimes, if no mulching is practised, intensifies the ill effects of drought and the heat of the sun's rays.

Trees should be forked around with the operator's back to the stem so as to allow of the roots spreading, The drainage afforded, must be better even than that of a sugar estate, in first-class order, and every effort must be made to give the young palms, by aerating the soil, an opportunity of securing a good and deep root-system.

It will be necessary to form a sanitary gang whose duties should be to keep a constant look-out for the coconut beetle and other well-known pests. This gang should also report at once the presence or even the suspicion of any disease.

An enormous amount of what may be termed mechanical damage, is done to coconut palms in this colony. Labourers think nothing at all of cutting notches in the trunk, sometimes to facilitate the climbing of the palm, and sometimes out of sheer wanton worthlessness. Also in the picking of the nuts, considerable damage frequently occurs, through mere carelessness, to young fruit and to the crowns of the palms. It is obvious that when injuries, such as these, are inflicted there is an excellent opportunity afforded for pests and diseases to gain an entrance. One has but to look at a number of our old palms to see the ravages made by the larvae of the large *Castnia daedalus*.

In Trinidad, very great care is exercised in the gathering of nuts. The operator has a rope around his waist so that he never actually enters into the tree and is able to slip all round the crown with both hands free. He is provided with a special implement for this purpose, one of far superiority to the local cutlass, which performs so many duties, both useful and otherwise, in the hands of our local agriculturists.

This tool is about the length of our cutlass, but has a sharp cutting edge on both sides and a broad cutting edge at the end, so that, nuts, with a thrusting upward blow, can easily be severed. The advantage of this is, that, only ripe nuts are picked, and there is no damage done to young fruit or flowering branches.

Local " pickers " usually climb into the crown of the palm, and with their feet, kick at " trusses " of fruit, which method often does considerable damage to flowers and young fruit. When it is remembered that, it takes some 364 days before the nut, from the time the flower has been fertilised, to become fully ripe, it will be seen what an enormous wastage can occur.

It is a mistake to think that it is a point of sanitation, to remove hanging leaves, to clean the crown, and remove the "strainers" or fibrous stipules. It is very much better to leave this to Nature. The undue removal of all dead matter exposes the soft wood underneath, and renders the palm more liable to insect and other attacks.

Farmers in this Colony adopt many weird practices in order to get rid of the Rhinoceros beetle (***Oryctes*** species) which is so often a menace to young trees. The method adopted by the writer was to soak rags of cloth in carbon-bisulphide, and to push this into the hole and ram and seal the hole with wet clay. This proved very effective.

Sanitation should be directed towards the fields themselves—no debris of rotting leaves and stems should be allowed to accumulate and harbour pests. Fields should be systematically cleared and debris burnt off as a matter of routine.

The use of fire should be undertaken with care. Frequently one sees in this Colony, damage of quite a severe nature, as the result of the careless use of fire, in a cultivation of palms.

With regard to the attacks of ***Brassolis sophorae***, a special gang should be kept, in districts where these pests are prevalent, whose duty should be to destroy the nests of these at their very first appearance. The old adage that "Prevention is better than Cure" is as true to-day as it ever was. The writer by keeping an extremely sharp look out for this pest, and nipping the attacks in the bud, was able to keep an extensive cultivation free of this pest, though neighbouring plantations suffered severely.

Coconut growers may rest assured that the care and attention given by sugar planters to their cultivation is not done for any reason other than the fact that they know by experience that it pays to do so. If so much care is necessary for a grass, for after all the sugar cane is a grass, how much more necessary is it that a coconut cultivation should be treated seriously and proper cultural methods carried out.

If good sound nuts are to be obtained, if healthy palms are to be grown giving maximum yields, attention must be given to every detail of cultivation, quite as much if not more so, as in the case with a sugar plantation.

It is far better to have a small cultivation giving excellent returns than to have large areas with diseased trees dying here and there and getting a paltry average yield of some 18 to 20 nuts.

A tree which is said to provide everything necessary for life, which lives and produces fruit for such a number of years, is worthy of far greater care and attention than is given in this Colony.

If one considers the absolute lack of cultivation that this palm receives at the hands of our local growers, and what results are obtained in spite of this neglect, it can readily be conceived what a flourishing industry this palm could provide if proper cultural methods were in existence and care and thought given to its cultivation.

We plead with our farmers to take this matter seriously, to make use of the services of the Agricultural Instructors of the Department of Science and Agriculture.

* * *

MEETING OF THE BOARD OF AGRICULTURE.

A Meeting of the Board of Agriculture was held in the Committee Rooms, at the Public Buildings, on Friday, 24th day of September, 1926 at 2.30 p.m. The following were present :—W. Francis Esq., F.I.C., (Acting Director of Science and Agriculture), Chairman; Dr. C. L. Whittles, B.A., (Superintendent, B. G. Sugar Planters Experiment Stations); E. M. Walcott, Esq., F.R.; Thomas Earle Esq., G. E. Anderson Esq., (President, Royal Agricultural and Commercial Society); Captain E. Beckett; F.L.S., H. A. Britton Esq., (President, B. G. Farmers' Conference); Dr. F. Wills, C. R. Williams Esq., G. L. B. Gall Esq., (Director of Co-operative Societies), with E. M. Peterkin Esq., Secretary. The Acting Government Veterinary Surgeon, Dr. S. N. Bruce, was also present.

Excuses were tendered on behalf of the Hon. R. E. Brassington, S. H. Bayley, Esq., the Hon. G. D. Bayley, the Hon. J. J. DaSilva and the Government Economic Biologist.

The minutes of the previous meeting held on the 26th of May, 1926, having been circulated to the members of the Board and having received their approval, were on the motion of the Chairman seconded by Dr. Whittles taken as read and confirmed.

The minutes of the meeting held on Thursday, 29th July, 1926, for the purpose of inspecting the Gardens were read and confirmed.

The Chairman reported :—

The appointment of Mr. G. L. B. Gall, Director of Co-operative Societies as a member of the Board.

The affiliation of the Victoria-Belfield Agricultural Society.

The affiliation of the Plaisance-Sparendaam Agricultural Association.

The affiliation of the British Guiana Farmers' Conference.

The disposal of the Shorthorn bull, "Francis," at auction for $60.00.

The death of the Holstein bull "Texas Wonder."

Mr. Walcott proposed seconded by Mr. G. E. Anderson that Dr. A. M. Fulton, Veterinary Surgeon, be appointed a co-optative member of the Live Stock and Veterinary Committees. This was carried unanimously.

An application for two months' leave of absence from Mr. H. L. Humphrys was granted.

The Chairman laid on the table :—

The Journal of the Board of Agriculture, Volume XIX. No. 3.

A report on "Kosters Curse," Clidemia hirta, Don., by the Assistant Botanist and Mycologist.

The Chairman exhibited specimens of Antidesma in flower and fruit, and informed the Board that the authorities at Kew had identified the specimen sent them as Ghesaembilla and not Venosum, and read a note by Mr. Altson pointing out that its history published as Venosum was incorrect, and giving data as to its introduction, etc.

Mr. Anderson said that the history of the plant was not important. It was useless to send warnings to estates to take steps to get rid of this pest in their cultivations, as long as the Cemetery and the Botanic Gardens remained as sources of infection. Mr. Britton thought they should make some definite recommendation to the Government to have the pest eradicated.

Dr. Whittles reported that he had found some growing in his compound at Vlissengen Road, which was heavily impregnated with salt; and was of the opinion that it could grow anywhere.

The Chairman said he had submitted a report to the Government on the subject, suggesting the clearing of the Gardens and the D'Urban Park of the pest.

Mr. Britton moved :—

" That the Board view with great alarm the rapid
" spread of Antidesma and strongly recommend to the
" Government the pressing necessity for immediate steps
" to be taken for its eradication ; and further urge that
" legislation be introduced to meet the situation."

Dr. Whittles seconded and the motion was carried.

The question as to whether legislation be enforced to prohibit the cultivation of Indian Corn in near proximity to Sugar Cane was discussed.

Dr. Whittles said that there were some canes at Sophia that in his opinion were suffering from Mosaic, he differed in opinion from the technical officers of the Department of Science and Agriculture, as to the presence of Mosaic in the Colony ; and he considered it important to reduce the chances of infection to a minimum. The precautionary measure would prove of great value.

Mr. Anderson said that if the disease was present at Sophia it should be notified officially ; the Secretary was instructed to notify the Government Mycologist and to ask him to report on same. After some discussion, it was decided to leave the matter over to be dealt with by the new Director of Science and Agriculture, who is an eminent plant pathologist.

Questions and motion by Mr. H. A. Britton, President, British Guiana Farmers' Conference.

Questions :—

1. Whether or not the Department of Science and Agriculture will consider the advisability of undertaking at once a survey and analysis of the soil of the coastal belts of the Colony, with a view to advising the small farmers, regarding the kind of crops that can be profitably cultivated on the soils in their respective districts. ?

Mr. Walcott said he knew that the Agricultural Instructors sent samples of soil to be examined. They should inform the Associations that farmers could have samples of soil examined, by applying to the District Agricultural Instructors.

2. Will the Director, save and except there be valid grounds and good reasons to the contrary, appoint and have among the several Committees of the Board, a purely Agricultural Committee.

The Chairman said he thought there should be a purely Agricultural Committee.

Mr. Walcott pointed out that a committee to deal with purely agricultural matters should be a Committee comprised of agriculturists.

3. Are there in existence any rules governing farming competitions among members of Associations affiliated to this Board ; if none exist, will the Director undertake to draft such rules for approval ?

The Chairman said there were no rules, but each Association framed its own.

The Secretary stated that the only people who could compete were members of the District Affiliated Associations.

Dr. Whittles suggested the adoption of the rules of Farmers' Competitions of the Royal Agricultural Society of England. This was approved of.

Motion :—

" That this Board recommend to Government the " advisability of their nominating Mr. D.D. Haynes for " another term, and thus enable him to complete the full " three-year Diploma Course at the Imperial College of " Tropical Agriculture ; and further that this Board re-" commend to the Combined Court the granting of $500 " to Mr. Haynes. "

Mr. Anderson, in seconding the motion, said he felt that having spent money on Mr. Haynes and his having reached the stage mentioned, it would be a waste of money not to permit him to complete the course.

Mr. Walcott said he would like to know what was the result of the last examination. The Board and the Government should know what progress Mr. Haynes was making.

The Chairman said that this matter of Mr. Haynes was being considered by the Government.

Mr. Walcott suggested that they might make the recommendation subject to Mr. Haynes having passed his last examination. This was carried.

The Chairman then adjourned the meeting to a date in January to be fixed later.

THE CULTIVATION OF TOBACCO.

By T. A. Archer,
District Agricultural Instructor.

Tobacco plants grow from seeds which are very much smaller in size than mustard seeds.

The seeds are often sown on nursery beds, when the cultivation is to be somewhat extensive, and in well-prepared boxes, if only a small plot is to be attempted. They take from five to seven days to germinate under good conditions, but many more days when conditions are unsuitable.

The plantlets are to be carried to the field when they are seven and eight weeks old, by which time they will be about three or four inches in height. After the ninth week the remaining plants will be too old and will not do well if planted.

While the tobacco plants, when once they are well established on good soil and under favourable atmospheric conditions, are fairly hardy, they are not so in their earlier stages. At this period the young, tender plants need the most careful attention. Even then, from ten to thirty per cent. of the number planted out often die, or are destroyed by worms or crickets. To meet this contingency, 50 per cent. more plants should always be estimated for than would be actually needed to plant a given area. Failure to provide for this eventuality would be disastrous.

The nursery beds are to be kept scrupulously free of weeds or grass, and must be constantly watched and examined for the enemies of the plants. No known plant has more enemies than the tobacco plant, especially at the earlier stages. These enemies do not come as spies, but in battalions. They must be pursued, captured and destroyed summarily. Every reinforcement of them should be similarly dealt with.

With proper care, a crop can be reaped in the space of three months after the planting has been done. The second and third crops, or ratoons from the stools, will, with careful attention and proper cultivation, aided by a liberal supply of good farm-yard manure, be ready in 6 and 12 weeks respectively after the reaping of the first crop. After this, a general stumping and replanting will be advisable. The plants, as a rule, respond admirably well to manurial influences, and the grower should be very liberal to them in this respect. To set the seeds, a bed, six inches higher than the general level of the land, running north and south, should be made. It should be three feet wide. Its length to depend upon the amount of seedlings required, or the area to be put under cultivation. Select good seeds for sowing always before hand, and at same time decide the area to be planted. The land for this purpose should be very well ploughed and pulverized, removing all pebbles and hard lumps of earth. Now spread a good layer of dry twigs over the bed and permit it to remain for a week or ten days, and then burn off. This operation is for the purpose of ridding the prepared surface of any rank weed that will by this time be growing up. Now put on a good layer of well-cured farm-yard manure and mix well to a depth of three or four inches. Then mix one or two spoonfuls of selected seeds, according to the length of the bed to be sown, with slaked lime, or cornmeal in the proportion of one to six, and sprinkle evenly over the prepared surface, press down lightly with a flat smooth piece of board, water lightly and the sowing is done.

Now erect a suitable lean-to over the bed with the higher side looking east, and cover with coconut leaves. Water daily with a watering can, the holes on the nozzle of which must be very small, so as not to up-root the plant. Continue this operation, except when it rains, until the plants are removed to the field. The covering over the bed should be removed for a few hours every day, a week or two before the time for planting, in order to harden the plants by exposing them to the sun.

HOW THE PLANTING IS DONE.

As the tobacco plants take the nature of garden plants, it is always advisable to make beds for them for the reason that they must be watered, when there is no rain, at least twice daily. The beds enable the watering to be done without trampling on the soil round and about the plants for the drains between them would be used as so many path-ways in which to walk while the watering is carried on. The beds, after a good, deep ploughing has been done, should be made four feet wide and at least 6 inches high, with a two-foot wide drain between every two of them. Any length of bed would do. Now make holes 12 inches in diameter, 3 feet apart on both sides of each bed six inches from the edges. Fill these holes, which should not be less than 5 inches deep, with well-cured farm-yard manure. Mix well together the earth with the manure and form hillocks in the centre of the mixture. Now make holes in the middle of these tiny hills with a piece of stick or the fore-finger and put in only the roots of the plants. Ram them very gently all round. Water them at once, and the planting is done.

It is better to plant in the evening time or during a cool, wet day. To insure success every plant put down should be sheltered for a few days. Keep the plants clean, and mould them in the shape of a whorl, when moulding is needed.

HOW TO REMOVE THE PLANTS.

The nursery beds must be well watered about ten minutesor so before the planting commences, so as to soften the earth, thus permitting the removal of the plants with as little hold of injury to their tiny roots as possible. Now take hold of the plants one by one, with the thumb and index finger of one hand and pull gently by slight, jerking motions until the number of plants required are removed. Do not handle the tiny roots, but shake gently all the earth from them that you possibly can before planting them.

SOIL.

A rich loam is best for the plants. Heavy clay is not good, nor are sandy and calcareous soils. A sandy loam rich in vegetable matter will also do.

DRAINAGE AND TILLAGE.

These must be very good in order to secure the well-being of the plants. A good water supply is indispensable.

HARVESTING.

As all the leaves of the tobacco trees do not mature together, reaping will perforce go on for some time before the final cutting down of the trees takes place. The ripe leaves are gathered as they appear from time to time and taken to the drying-house. The ripe or matured leaves exhibit the following characteristic features :—they curl, are sticky to the touch ; have yellowish spots on the surface of the leaf-blades and when the tips of them are suddenly bent they break with a sharp cracking sound.

TOPPING.

This is the term used for nipping off the tobacco blossoms as soon as they appear. The object of this operation is to arrest the fruit-bearing energy, and divert it towards the foliage.

DISBUDDING.

After topping the plant, the dormant buds, at the axils of the leaves, which by the way, are alternate, sessile and hairy, will start to grow rapidly. These are to be removed constantly, or the energy arrested from the blossoms will go into the young shoots instead of the leaves for which it was intended and the crop would be spoiled to a great extent. Care should be taken to leave a few robust trees untopped, so as to secure seeds for future planting.

When all the upper leaves of the plants are ripe all the plants are cut down with a sharp implement to within 4 inches of the bases of the trees. The ratoon, if any, should not be damaged. Three or two, according to the strength of the stools, of the most promising ones, should be left on each stool.

HOW THE DRYING IS DONE.

The leaves are hung in pairs three or four inches apart when they reach the drying house.

When reaped in the field, both trees and leaves must be left to wither for some time before they are removed to the drying house. They will become somewhat tough, and will not so easily break when handled in transit. The tree should be suspended singly. The leaves should barely touch one another. The distance apart in this case depends on the size of the leaves on the trees. In 30 or 35 days the mid-ribs of the leaves will be quite dry. The leaves must now be put through the fermenting process, which is the most important of all, since, if it be not properly done, the whole crop will be good for nothing

HOW TO FERMENT THE LEAVES.

Strip the leaves off the stems and separate the fillers from the wrappers. Open them evenly and place them one on the other on different piles, on a suitable platform, with their tails all in the same direction. Cover the piles with dry banana leaves thickly. Then cover these with clean sacks, and put on heavy weights over them. After 24 hours the heaps must be broken up properly to allow the leaves that were in the middle to get to the top and those that were on the top to get to the bottom and those from the bottom to get to the middle. Repeat this operation for three successive days and after, at intervals of two or three days for 30 days, when all the heat will have passed off and the necessary chemical changes taken place.

Select a cool moist day for this work.

WORMING.

In the drying house great care must be taken with the leaves. The voracious sphinx moth caterpillars often play havoc with the leaves. By keeping the floor of the house clean always, the droppings from them would be easily seen, and their exact position discovered. They must be hand-picked and destroyed. They must be looked for at least twice a day.

THE DRYING HOUSE.

This should be well constructed with doors and windows. The frames for the leaves and trees should run across the building in tiers one above the other, with a clear space of four feet between any two tiers in order to facilitate attention to the leaves. Accordingly the building must be of fair altitude, and good dimensions, which are factors productive of good ventilation. With bad ventilation the mid-ribs of the leaves will sponge and finally the leaves. Mildew, too, grows rapidly in badly ventilated places especially in wet weather, so that all this should be borne in mind when constructing a drying house for tobacco.

Finally, after the fermenting process is over, the piles of tobaaco must now be broken up and made into hands.

This is the term used for tying together, with an unsound leaf, the heads of from 12 to 30 leaves. The hands are then well packed into air-tight chests or barrles, using much force in the operation in order to exclude all the air possible. Cover the vessels hermetically and the product is ready for the market, or it can be kept indefinitely.

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first nine months of 1926.

The corresponding figures for the same period during previous years, and the average for the same period for eight years previous to that are added for convenience of comparison.

Product.	*Average 1916-23.*	*1924.*	*1925.*	*1926.*
Balata, cwts. ...	4,432	5,174	4,872	4,794
Cattle-food (Molascuit) tons	1,006	644	861	540
Cacao, cwts. ...	84	None	None	None
Cattle, head ...	344	252	429	11
Charcoal, bags ...	35,940	31,502	22,653	24,945
Citrate of Lime, cwts.	214	None	None	None
Coconuts, thousands	1,795	1,257	963	562
Coconut Oil, gals. ...	14,919	17,405	20,815	15,431
Copra, cwts. ..	1,578	13,511	10,552	32,627
Coffee, cwts. ...	4,081	4,579	5,231	6,700
Essential Oil of Limes, gals. ...	255	90	90	228
Firewood, Wallaba, etc., tons	5,796	5,132	4,607	5,760
Gums, lbs. ...	2,224	708	477	1,232
Hides, No. .	4,746	7,174	7,620	7,089
Kola-nuts, cwts. ...	7	None	None	None
Lime Juice, gals. ...	5,754	3,361	5,474	2,511
Lumber, ft. ...	153,021	93,508	111,256	139,827
Molasses, gallons ...	44,972	302,046	527,272	954,854
Pigs, No. ...	243	270	688	411
Railway sleepers, No.	10,042	11,802	30,591	10,743
Rice, tons ...	6,730	2,557	4,880	1,770
Ricemeal, tons ...	57	None	None	None
Rubber, cwts. ...	73	3	24	218
Rum, gallons ...	1,870,084	641,149	900,693	603,729
Sheep, head ..	32	35	10	None
Shingles, thousands	1,652	932	1,202	1,049
Sugar, tons ..	57,074	51,520	59,500	57,195
Timber, cub. ft. ...	77,985	135,095	146,975	226,781

Meteorological Data—July—September 1926.

Recording Stations & Months.	Rain-fall.	NUMBER OF DAYS OF RAIN						Evapo-ration.	Air Temperature and Humidity.			
									Air Temp.			
	Total Inches.	Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Inches	Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
July ...	11·60	6	6	4	5	...	21	4·44	86·1	75·5	80·8	79·6
August ...	9.82	8	5	3	4	...	20	5·22	82·2	75·7	78·9	79·8
September	2·77	4	8	1	...	...	13	5·37	81·6	76·7	79·1	79·9
Totals	24·19	18	19	8	9	...	54	15·03				
Means.	...	...	...	...	...	...	...	...	83·3	75·9	79·6	79.8
Berbice Gardens.												
July ...	7·43	4	11	5	1	...	21	...	88·7	74·3	81·5	86·8
August ...	4·56	5	7	3	...	...	15	...	89·9	74·9	82·4	75·8
September	2·64	3	3	1	1	...	8	...	90·8	76·2	83·5	74·8
Totals	14·63	12	21	9	2	...	44	...				
Means.	...	...	...	...	...	...	...	...	89·8	75·1	82·5	79·1
Onder-neeming.												
July ...	10·23	2	6	2	6	...	16	...	88·0	73·0	80·5	...
August ...	7·00	...	5	...	5	...	10	...	89·0	74·0	81·5	...
September	2·37	...	3	1	1	...	5	...	90·0	73·0	81·5	...
Totals	19·60	2	14	3	12	...	31	...				...
Means.	...	...	...	...	...	...	...	...	89·0	73·3	81·2	...
Mora-whanna. N.W.D.												
July ...	16·29	3	10	7	1	3	24	...	...	...	...	...
August ...	8.28	2	13	7	1	...	23	...	...	...	...	...
September	6·79	3	12	3	1	...	19	...	...	...	...	...
Totals ...	31·36	8	35	17	3	3	66	...	...	...	...	...

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,209
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,086
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,008
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,950
1923 ...	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,388
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,330
1925	3,317	2,755	1,580	1,819	470	1,663	1,597	13,201
1926								
1st quarter	545	935	410	494		175	614	
2nd quarter	363	561	321	432		225	379	
3rd quarter	444	538	65	448		401	300	

I. A. R. I. 75.

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